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Mobile Phones: An Appropriate Tool For Conservation And Development?

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Executive Summary 1

Mobile phone technology is developing at an extraordinarily rapid pace and is being applied to an increasingly wide range of human activities and the environment in which we live. It brings both benefits and challenges. This report looks at the implications and applications of mobile phone technology on conservation and development initiatives in the developing world. It takes into account the integration between mobile phones and other Information and Communication Technologies (ICTs), identifying ways in which mobile phones play a role in the digital divide debate. Having considered the policies of governments, donors, businesses and non-governmental organizations (NGOs) towards mobile phones and other ICTs, the report details a number of case studies where they are being applied to development and conservation work.

The research for the report was mainly desk-based, although complemented by field research coming from an existing Fauna & Flora International (FFI) project in southern Africa.[1] It does not attempt to examine the whole range of ICT applications and initiatives being used in development. Nor is the report a definitive account of the use of mobile phone technology for conservation and development projects. Nevertheless, we hope the report can contribute to the understanding and debate of the use of mobile phone technology in these areas, and perhaps for the first time, bring together a whole range of projects and practices.

[1] *The project, 't4cd' (technologies for conservation and development in southern Africa) is a joint venture by FFI and its partner organization in South Africa, ResourceAfrica.*

The following conclusions are drawn and recommendations are made:

1. Mobile phones have fundamentally changed how we communicate in society. They have become a dominant technology in the developed world. With innovation racing ahead in the West, there is the danger of developing countries once again being left behind, this time technologically (what is called 'the digital divide').

2. However, the impact of mobile phones has possibly been more profound in developing countries that have had poor telecommunications infrastructure. To an extent, mobiles are 'leapfrogging' the technological gap between the developed and developing world.

3. Historically, there has been a slow uptake of many ICTs in developing countries, due to equipment costs, lack of infrastructure, logistical problems, lack of finance or political/commercial commitment. On the other hand, mobile phone growth in the developing world has been staggering, due to ease of network expansion, cheaper relative costs, high demand, and willingness of companies to invest. Rates of mobile phone uptake have differed markedly between and within countries in the developing world.

4. On their own, however, mobile phones will not, and cannot, bridge the digital divide. They must also be considered alongside other ICTs in an

integrated approach. Mobile phones may not always be the most appropriate form of technology, even where there is good Global System for Mobile Communications (GSM) coverage.

5. It is important to emphasise that mobile phones and other ICTs are only tools, and *not* a solution in themselves to the problems encountered in the conservation and development arenas. In this respect, ICTs should be seen as tools of wider strategies and programmes, which aim to deal with threats to wildlife and the environment, as well as poverty.

6. Conservation and development projects applying ICTs at the community level should consider access criteria for bridging the digital divide. Issues of access, appropriate technology, affordability, capacity, content, socio-cultural factors, trust, legal and regulatory frameworks, local economic environment, macro-economic environment, political will, relevance and using existing infrastructure, are all highly relevant. If not properly considered, there is a danger of failure.

7. Governments, business and civil society are all engaged in developing strategies and applications for ICTs in development, and sometimes, conservation work. The challenge for governments, business and civil society alike is to consider the above-mentioned criteria in their policies, programmes or business plans. For an international conservation agency, such as FFI, there is an equally complex challenge of incorporating such criteria into the piloting and development of ICT applications in support of its conservation programmes in order to demonstrate that there is the potential for biodiversity gain.

8. It is important to realise that mobile phone applications in the developed world can be adapted to the developing world, and visa-versa, providing there is commitment, resources, and involvement of local partners. In Europe, there are projects underway, or being piloted, that use mobile phone technology to support socio-economic development and environmental activities.

9. It is an encouraging sign that some, but not all, of the major mobile phone operators in Europe have published Corporate Environmental and Social Responsibility (CESR) policies. This is undoubtedly good business practice, as well as opening up the opportunity for conservation agencies to pilot and develop applications for conservation projects.

10. As for any sector, there are clear business drivers, as well as CESR expectations, for mobile telecommunications companies to engage in conservation and development. And there are many, generic, environmental management issues, which companies should monitor, including energy efficiency, transport and water consumption. But there are also a variety of industry-specific issues that need to be considered: environmental impact of network rollout, waste management/end-of-life product control, and supply chain management.

11. Mobile phone companies should consider measuring how they perform against internationally agreed environmental goals, and the Millennium Development Goals (MDGs). This is a challenge to the corporate sector but it could be incorporated into future CESR reports.

12. Any ICT project for conservation and development should consider working in partnership with private business, government, civil society and academia. A wealth of experience and knowledge resides in the various sectors. The wheel should not be re-invented in different places, but replicated. A forum between the different parties could be established to share learning and experiences, both positive and negative. For example, the World Summit on the Information Society (in December 2003) was a good opportunity for different stakeholders to come together and share experiences.

13. If introduced appropriately, mobile phones can be a useful tool for development. There are a

number of examples from around the world which demonstrate the use of mobile phones in support of development work. Mobile technology is being used in rural phone networks, telemedicine, small business development, market trading and farming, humanitarian aid and community services. There are definite benefits of the use of mobile phones in supporting development, although certain criteria are necessary for their application to be successful.

14. In one particular area of development – microfinance – mobile telephony is being introduced and piloted extensively. Besides microfinance institutions (such as the Grameen Bank), the corporate sector has seen the potential value of using mobile phone technology for commercial applications in the microfinance sector. There are potential benefits, as well as concerns, about the technology being adapted to meet the needs of the poor.

15. Due to the isolation of many conservation areas, mobile phone use is often restricted. Where they are used, it tends to be on a practical level only, providing simple but crucial voice communications. Hence, an even greater reason to consider other technologies.

16. ICTs can be used to benefit biodiversity and conservation in a number of ways. There are case studies from around the world that demonstrate potential biodiversity gains of ICT use in the following areas: at a practical, hands-on level; basic data collection, information, education and research; community-led conservation initiatives; conservation project management; tracking and monitoring.

17. A whole range of other ICTs are being applied to conservation work based on a pure scientific need, such as with the tracking of species or the implementation of GIS to digitally map the natural environment. At another level, the simple introduction of mobile phone coverage into an area can present huge benefits to both conservation organizations working in the area, and the local communities, without the need for any direct conservation NGO intervention. Indeed, NGOs encouraging mobile phone operators to extend coverage into national parks and reserves by presenting a strong business and biodiversity case is already happening.

Setting the Scene 2

2.1. Mobile phones: The global picture

> Phones are now the dominant technology with which young people, and urban youth in particular, now define themselves. What sort of phone you carry and how you customise it says a great deal about you, just as the choice of car did for a previous generation.
>
> The Economist (2004a)

> The good news for Iraq is that the use of mobile phones has increased several hundred-fold since before the war . . . The bad news is that the supply of electricity, of vastly more concern to millions of sweltering Iraqis, is still below the pre-war level and at that only for a limited time each day.
>
> The Guardian (2004a)

The mobile phone dominates our lives. It is more than just a 'must have' item in developed, western countries. To many young people, it has become a fashion item. Uptake in more established markets has now reached saturation point; there are currently more than 51 million users in the UK (BBC News Online, 2003b). While the demand for mobile phones seems to be insatiable, it is after all only a technology. There are always going to be more pressing needs. Nevertheless, it is a technology that has the potential to have a positive impact in society.

The mobile phone industry is unique in its rate of innovation – both in terms of the handsets themselves and the range of services on offer. Over the past couple of years in particular, the mobile phone has become a key information communication device, spurred on by the earlier introduction of text messaging (Short Message Service, SMS) and the more recent mobile internet (Wireless Application Protocol, WAP) services. In its early days, WAP was over-hyped and badly promoted to a sceptical public, resulting in disappointing uptake. For many, expectations of the 'mobile internet' were just that, and handsets at that time simply were not able to deliver.

More recently, however, the introduction on some phones of colour screens, polyphonic sound[2], built-in cameras and innovative operating systems such as Symbian[3] has enabled WAP-related services to come of age, and services such as Vodafone live![4] are a testament to how far things have come. The rollout of 3G[5] networks will significantly enhance the services on offer, and the continuing trend to provide mobile access to websites, albeit still limited at present, is a classic example of how the two technologies are beginning to converge. As a result, competition amongst mobile phone companies has boomed, with new firms trying to get a piece of the action in a market estimated to be worth over US$70 billion worldwide (The Economist, 2004b).

With innovation racing ahead in the West, there is the danger of developing countries once again being left behind, this time technologically. The aptly

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[2] Polyphonic – the ability to play two or more independent sounds at the same time.
[3] Symbian – an advanced, open operating system used in many new data-enabled mobile phones.
[4] Vodafone live! – the mobile internet platform of Vodafone.
[5] 3G – third generation (mobile phones), which provide enhanced speed and richer content (such as videos and photo-messaging).

titled 'digital divide' was already an issue, with emphasis on access to telephones, computers and the internet. For reasons discussed in section 3.2, mobile telephones have been able to 'leapfrog' some of the barriers, and as a result have found themselves at the forefront of the digital divide debate. The impact of mobile phones has been considerable.

People in some of the poorest parts of the world now have access to mobile technology. Addressing their specific needs, and supporting and encouraging the use of mobile technology as a force for positive social and environmental change presents the industry with unique challenges and opportunities.

2.2. A view from the developed world

> The mobile phone has rapidly become an integral part of our lives. In many countries more than half the population uses a mobile phone and, in some developing economies, mobiles are often people's only means of telecommunication.
>
> Sir Christopher Gent, cited in Vodafone CSR Report (2003)

> Aside from yet-unanswered questions relating to health, the positive use of mobile technologies lies largely in our hands – in the hands of government, when it comes to environmental issues and safety regulations; in the hands of operators, who can do much to ensure the smooth integration of the technology into our society, both in terms of equipment design and aesthetics, and through initiatives which help train people in mobile phone etiquette; in the hands of employers, who can take pains to ensure staff with corporate mobiles are not abused; and ultimately, in the hands of users, who need to cultivate a greater level of awareness and work to ensure that their phone use does not negatively impact the lives of those around them.
>
> International Telecommunications Union (2004)

It is important to recognize that mobile phone innovations in the UK in support of developmental, environmental and conservation needs could easily be adapted in the rest of the world.

Box 1: The digital impact: mobile phones

- By May 2004 there were an estimated 1.325 billion mobile phone subscribers globally;
- Between 1995 and 2005, the number of mobile phone subscribers across Africa is forecast to leap one hundredfold from 652,000 to over 67 million;
- During the first quarter of 2004, over 153 million mobiles phones were sold globally;
- Global revenue from mobile services leaped from US$19 billion in 1991 to an estimated US$414 billion in 2003;
- By 2003, there were an estimated 80 million browser-enabled mobile phones (with Internet access), up from 1.1 million in 1999. The number of mobile internet users is forecast to hit 600 million by 2008;
- In 1991 the number of fixed lines in use around the world totalled 546 million, compared with just 16 million mobiles. By 2002, the number of fixed lines doubled, whilst mobile lines have increased over seventy times;
- In Bangladesh, an investment of $80 million by Grameen Phone provided cellular phone service to rural areas, covering 100,000 subscribers in 250 villages.

Sources: Gartner Group, NUA Internet surveys and News, Africanews, Inktomi, asia.internet, e-commercetimes, Financial Times, Jupiter Communications, Cnet, Forrester Communications, PC Magazine, Far Eastern Economic Review, Hindustan Times, IDC, Forbes, MobileChoice, International Telecommunications Union (ITU)

Box 2: How mobile phones have changed everyday life in the Democratic Republic of Congo – a western perspective

My first visit to the Congo was in 1994, to a town called Goma in the eastern part of what was then Zaire, during the Rwandan genocide and refugee crisis. Like most international aid agencies, we were equipped with some of the most recent ICT equipment, including high-frequency (HF) radios and a satellite telephone. However, for the majority of the Congolese, there was no access to phones, the internet, or radios, let alone mobile phones. They relied upon traditional forms of communication, sometimes travelling hours to send a message, or crossing the border into Rwanda (which, in 1994, was not the safest thing to do). A few had fixed lines, but these were unreliable. Very few could afford to pay for email or voice calls on a satellite phone.

By 2003, however, one of the most dramatic changes in everyday life was the proliferation of the mobile phone. When I returned to Goma in this year, the mobile appeared to be an everyday item for some people, such as entrepreneurs, NGO staff, church leaders, government officials, cooperatives, and military officers. Instead of driving for a couple of hours, you could just make a call or text message, to arrange a meeting, buy and sell produce, pass on information, and so on. And this was taking place in a town where there are high levels of poverty, compounded by two protracted civil wars, a volcanic eruption, riots and looting, and the occupation by a foreign army, all in the last ten years. The majority, however, continue to have no access to mobile phones.

But the mobile has a 'reputation' in the Congo. At the turn of the century, a sudden boom in the price of coltan (a tantalum-bearing ore, used in the manufacture of capacitors for mobile phones and other hi-tech equipment), led to a short-lived 'gold rush'. While some benefited, the vast majority saw little reward. The exploitation of natural resources in the Congo has resulted in human suffering on an unprecedented scale, together with the destruction of wildlife and the environment, because it happened in a chaotic and unregulated fashion, largely controlled by military or political factions. The solution is to press for the regulation of coltan mining, for the benefit of the Congolese, private business and wildlife.

Richard Burge (2004)
See also Hayes & Burge (2003)

In Europe, projects are under way, or being piloted, which use mobile phone technology to support socio-economic development and environmental activities. These include sending data to doctors to facilitate remote diagnosis and provide patient support, mobiles being provided to flood victims in areas where land lines have come down, and farmers being able to update livestock databases via General Packet Radio Service (GPRS) on a mobile handset. By learning from these initiatives, knowledge and skills can be transferred to the developing world and adapted according to the particular context and need.

This learning and innovation requires commitment and resources. The Vodafone Group Foundation has given both, providing a grant to FFI to carry out research project development into how mobile phone technology can support international conservation and sustainable development efforts. This report is one product of the research. Its conclusions and recommendations are, however, made entirely independently of the company.

It is an encouraging sign that some, but not all, of the major mobile phone operators in Europe have published Corporate Environmental and Social Responsibility (CESR) policies. This is undoubtedly good business practice, as well as opening up the opportunity for organizations such as FFI to pilot and develop applications for conservation projects. At the same time, the CESR statements and activities of corporations should be continuously monitored, their impact evaluated, and their effectiveness improved. The challenge will be to put newly developed policies into practice. Chapter 4 looks into CESR issues in more detail.

A main focus of this report is to examine the benefits, or otherwise, of mobile telephony for conservation and development. While most of the case studies included are projects in the developing world, it is important to highlight a few examples in the developed world, which are promoting international conservation and development issues: SMS texting to campaign on fair trade (*e.g.*, The Catholic Agency for Overseas Development's Jubilee Campaign), SMS donating for good causes (*e.g.*, Comic Relief), and the use of the mobile internet to raise awareness and funds (*e.g.*, FFI's wildlive!, see Box 3 below).

2.3. A view from the developing world

> Africans' insatiable appetite for cell [mobile] phones has made the continent a profitable market for the high-tech gadgets, which were introduced only a decade ago. But in the intervening ten years, the sales figures have masked a larger social story: how the proliferation of cell phones is changing Africans' relationships with one another.
>
> Hall (2003)

> The growth of the cell phone industry in Cameroon is being choked by expensive cell phone handsets, with a motorbike being cheaper than a cellular telephone . . . Cameroonians are keen to be part of the world by using cellular telephones . . . Cellphone manufacturers and network operators themselves are best placed to change this dire situation, but they seem unaware or uninterested in solving the problem.
>
> Balancing Act (2004)

Box 3: wildlive! – a case study

Combined web/WAP approaches are nothing new to news service providers such as the BBC who have had a simple text-based, mobile news service available for some time.

There are unique opportunities for the conservation movement to harness mobile technology as a tool in promoting their work. December 2003 saw the launch of wildlive! – a joint venture between the Vodafone Group Foundation, Vodafone UK and Fauna & Flora International. A fully-featured website providing a wide variety of conservation news stories, discussion boards, field diaries, competitions, downloadable resources and image galleries was developed using a shared database which also feeds directly into a micro-site on Vodafone's live! platform. Vodafone live! users can access a wide range of these services, in addition to downloadable animal-sound ringtones, wildlife images and conservation-themed Java games. This is the first time that conservation-based materials have been made available to mobile subscribers, giving them the opportunity to engage in conservation in a completely new way. As wildlive! proved highly successful in the first six months after its launch in the UK, the Vodafone Group is expanding the service to engage live! users across the world in conservation.

Plans have also been put in place to create a 'low bandwidth' version of wildlive! This will feed conservation information through to earlier (legacy) models of handsets and, for example, allow tourists to receive location-specific information relating to the conservation areas they are visiting, or provide them details of local markets or cultural events taking place. These will be provided via simple WAP access, or via SMS, or a combination of both.

Box 4: The digital impact: other ICTs

- The cost of going online ranges considerably from US$18/month in Sweden to US$78/month in Argentina. On other hand, internet access in Chad costs US$10.50 for just one hour, where the average annual GDP per person is US$187;
- An estimated one in three internet users in 2003 accessed the web from North America. Five years earlier the figure was nearer one in two;
- E-business will account for 10% of the world's GDP by the year 2005;
- In industrialised economies, about 25% of consumer spending and 70% of business-to-business spending will be influenced by the internet;
- In 2000, 94% of all online transactions took place in the developed world, a 19:1 ratio against Africa, Asia and Latin America;
- India's software exports are expected to grow from US$4 billion at present to about US$100 billion by 2005;
- By 2005, global demand for specialized IT skills will outstrip supply by 20%;
- The Asia-Pacific PC market, excluding Japan, grew 35% in 1999 to 14.1 million units, while the number of internet users jumped from 12.9 million to 21.8 million. Within five years, the total is expected to reach 95 million.

Sources: Gartner Group, NUA Internet surveys and News, Africanews, Inktomi, asia.internet, e-commercetimes, Financial Times, Jupiter Communications, Cnet, Forrester Communications, PC Magazine, Far Eastern Economic Review, Hindustan Times, IDC, Forbes, MobileChoice, International Telecommunications Union (ITU)

Unlike countless other high-tech products, mobiles are finding a readily accessible market within developing countries. Demand is high and, although it is a relatively new industry, mobile phone service providers tend to be highly profitable, operationally at least. With some operators able to turn a profit within a few months of operation, in recent years there has been a 'scramble' for licences and partners. With global growth forecast to hit over 30% in 2004, the rush is easily justified as Africa alone is set to grow at twice that rate (CellularOnline, 2003).

A key reason for the historically low uptake of many ICTs in developing countries lies in equipment costs and a lack of supporting infrastructure. Logistical problems, such as the vast distances involved, and a lack of finance or political/commercial will, have meant that the expansion of fixed-line networks has been slow and, in some cases, non-existent. Mobile technology, on the other hand, can be implemented without the need to run cables over vast distances, and solar energy is often available as an alternative or backup power source. Such factors, coupled with huge consumer demand, the opening up of telecommunications markets, the willingness of network operators to expand into emerging markets and the relative ease of network implementation have made mobile phones the communication method of choice in many developing countries. Indeed, uptake in some cases has been staggering – the number of mobile users in Swaziland, for example, overtook the number of fixed-line subscribers in just two years (Hall, 2003).

As mentioned, mobile phone uptake has been dramatic in the developing world. Mobile phone services, such as text messaging, have proved incredibly popular in places like the Philippines, while in Bangladesh they have connected some villages to a modern communications network for the first time. This has surprised some development practitioners, who thought that mobile telephones were a luxury item of the developed world and therefore inappropriate for many in the developing world.

In Africa, the demand for connectivity has been phenomenal. The boom in mobile phone usage has largely been facilitated by the availability of cheap pay-as-you-go SIM cards and recycled handsets, which has allowed even the poorest members of society to make

and receive calls. Some observers highlight the many countries across the African continent that are now 'leapfrogging' older technologies. Mobile phones and other wireless technologies are often the preferred options (AllAfrica.com, Oct 2003). Their impact has been felt across the board, no less so in rural areas:

> Farmers are using mobile phones to ensure the best prices for their crops, small-scale entrepreneurs are contacting potential clients, and grandparents are talking to their children and grandchildren hundreds of kilometres away.
>
> IDRC (2003a)

Their positive impact – as a communications tool – can be seen when comparing past and current practice:

> What happens now is this. People have buyers for their maize, their coffee, their produce in town. So they call a buyer and say 'Hello, we have 10 bags of maize. Do you need them? And what's your price?' They get the answer and then they call another buyer to ask 'What's your price?' They get the best price. They ask: 'How do you want it delivered, when do you want it delivered.' In the past, they would just put it on a lorry and deliver even when the buyer is not interested, even when the market is down. Now, they actually find out.
>
> IDRC (2003a)

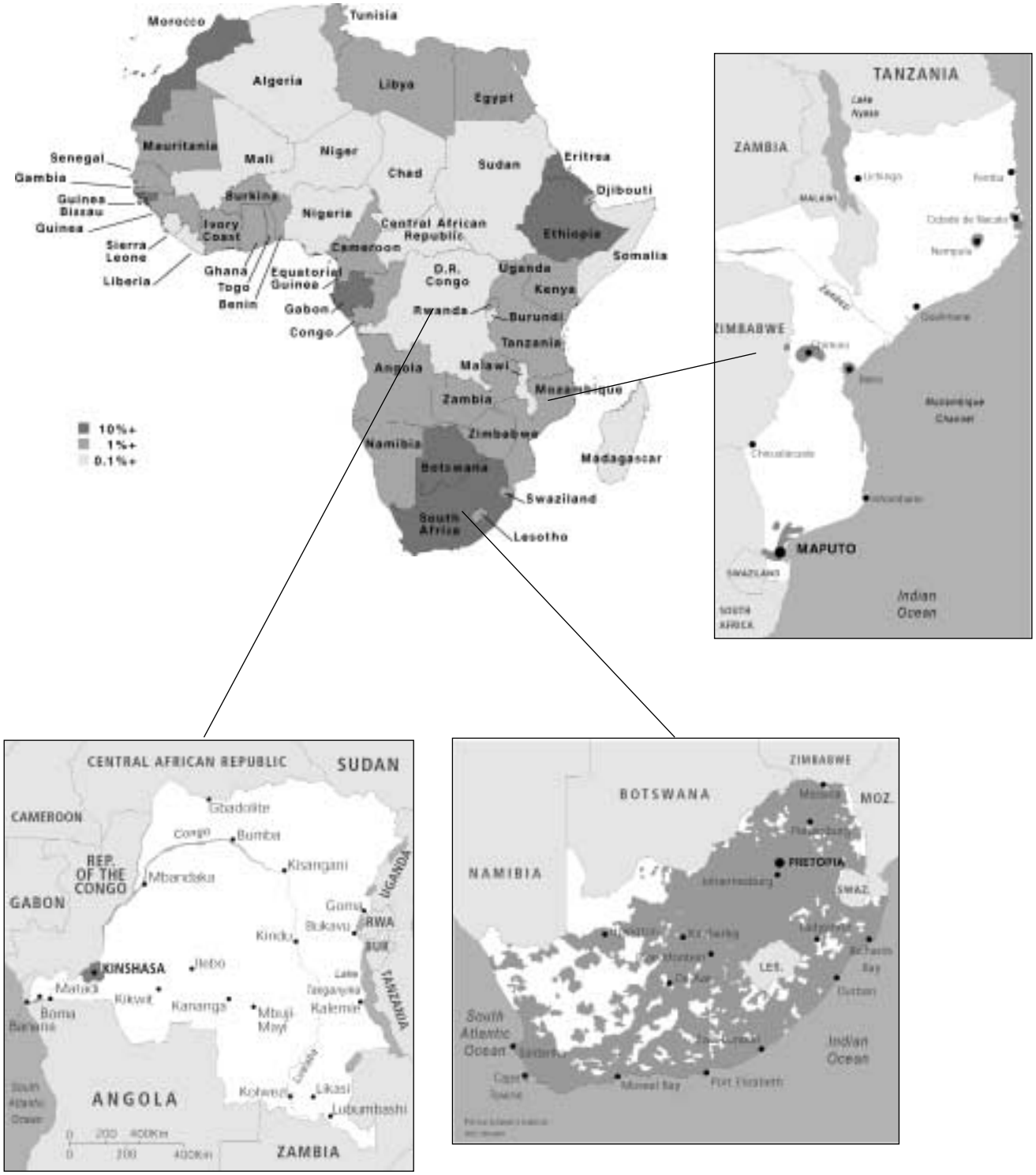
There has clearly been a great deal of enthusiasm for mobile phones in many developing countries as in the West, albeit for different reasons. In the case of Africa, this is partly attributed to traditional African culture, with its emphasis on palaver and oral story telling. In Nigeria, for example, the average mobile phone is used for 200 minutes per week, compared with just 120 in the UK (Hall, 2003). However, the higher usage may also be due to other factors such as the lack of landlines and email facilities, larger families and social networks. While oral communication may be popular, high levels of illiteracy in some countries may negate the ability of people to use phones for other purposes, such as reading text messages.

Despite all of this, mobile networks may not always be as flexible or cheap as other technologies. In some cases, such as in Cameroon, new handset costs can actually prove to be a barrier.[6] Fixed line technology, where it exists, allows for internet access and in many cases cheaper phone calls. Mobile coverage can prove rather sketchy in some areas (see Map 1), with competing network operators tending to concentrate initially on the larger towns and cities. As markets mature, however, coverage tends to spread gradually to more rural areas.

In reality, though, literally millions of Africans are making regular mobile calls. Mobile coverage is widening and increasing numbers of handsets are becoming available to developing world markets. What role can, and should, mobile phones be playing in helping to close the 'digital divide'?

[6] *However, there are schemes in the developed world such as Fonebak in the UK and the PhoneFund and CollectiveGood in the US, which have provided cheaper mobile phones in the developing world. These recycling schemes ensure that reconditioned handsets are sold to approved retailers in Asia, Africa and Eastern Europe.*

Map 1: In large parts of Africa mobile phone coverage remains limited



Penetration of mobile phone subscribers in Africa (Source: Cellular Online, 2003). Reproduced with permission.

The Digital Divide

3

3.1. Why should we be concerned with the digital divide?

Whether taken from the view of the developed or the developing world, the mobile phone is undoubtedly transforming society. Together with other types of ICT, the mobile phone is bringing about opportunities as well as challenges for all. On the one hand, it brings people closer together (sometimes called 'the global village'), enables electronic commerce and business, connects people to social services, and allows for a certain 'digital democratization'. On the other hand, the lack of coverage, infrastructure, access and knowledge, especially in many rural areas, has left many people even further behind in an age of 'digital development'. In varying ways, governments, civil society and businesses have attempted to harness the opportunities while addressing the challenges of the so-called the digital divide.

So, what is the digital divide? The standard definition is provided by the Organisation for Economic Co-operation and Development (OECD):

> The gap between individuals, households, business and geographic areas at different socio-economic levels with regard both to their opportunities to access information and communication technologies (ICTs) and to their use of the Internet for a wide variety of activities.
>
> OECD (2001)

While it is recognized that there is a digital divide within countries as much as between countries and continents, one of the concerns of this report is whether mobile phones can assist in closing the divide between the developed and developing world, or if they actually accentuate the gap.

3.2. Can mobile phones help to close the digital divide?

The value of the mobile phone to everyday life in the developing world is not disputed. However, despite the explosion of mobile phones in these countries, mass poverty remains the key constraint to the expansion of mobile phone access and use. The traditional view has been that people living on less than US$1 a day simply cannot afford to make a phone call, let alone buy a handset. So, how could mobile phones have any impact on their lives at all, except ensure that they are even further disadvantaged in the new digital revolution?

This is even more pertinent when considering the new applications being offered by the mobile phone, such as the mobile-internet, video-streaming and photo-messaging (services commonly known in the UK as 2.5G or 3G). At present, 3G phones are emerging on the African sub-continent, but the potential for uptake will be severely limited (News.com, 2003).

However, the traditional view is challenged when the reality is considered. As already seen, mobile phone use has boomed in many, but not all, developing countries. One of the advantages of mobile phones over other forms of technology is that they are more accessible in areas that lack ICT infrastructure. They are also more reliable in areas even where there are

fixed lines. In terms of affordability, the adoption of pre-paid phone cards has contributed hugely to the uptake of mobile phones in the developing world. It is arguable, therefore, that mobile phones are able to reach a larger number of people in the developing world than any other new technology. As one report notes about its ICT projects:

> Most target groups . . . cannot afford to buy or even access the technology used in the projects, with the exception of phones. The poor are, moreover, increasingly benefiting from the strategic use of telephone communication . . . (some projects) clearly demonstrate that telephone technology (landline and mobile) can be used effectively to answer the communication, information, and business needs of poor people in developing nations
>
> InfoDev (2003a)

One of the dangers, though, is to see the introduction of mobile phone technology and other ICTs as the *solution* for poverty reduction, sustainable development and, even, conservation. Some view mobile phones as the catalyst for socio-economic development. However, this is debatable, as there are very few reports that have measured the impact of mobile phones on communities, except perhaps for anecdotal evidence in the trade press or development journals. Furthermore, developing over-dependence on a technology, such as the mobile phone, carries its own dangers. For example, farmers relying upon a mobile-based payment and information system may find themselves unable to trade in the event of a technological breakdown.

A stronger argument is that mobile phones and other ICTs "should be seen as a means to help meet existing development objectives, in particular the international development goals for poverty reduction, education, health and environment, not as a separate sector or end in themselves" (OECD, 2003a). Hence, many regard ICTs as a *tool*, albeit a very important one, in the business of poverty alleviation.

This is a real challenge for the private business sector. As previously identified, some mobile telecommunications companies in Europe have developed CESR guidelines over the last few years. They have also supported social development projects in the UK and developing world. But how many of them have addressed wider developmental goals in connection with their business activities in the developing world? If companies started to address these as part of their commercial operations, it would add real value to CESR policies.

Crucial to this debate is whether or not mobile phone technology is able to play a role in bridging the digital divide. It is not just about expanding coverage into areas where previously there has been weak or non-existent telecommunications infrastructure. A number of criteria have to be met in order to help close the digital divide. The criteria outlined in Box 5 demonstrate what needs to be considered when looking at how modern technology (including mobile phones) could help close the divide. The piloting and introduction of mobile phone technology, in aid of conservation and development, should be measured against each of these criteria.

The challenge for governments, business and civil society alike is to consider these criteria in their policies, programmes or business plans. For an international conservation agency like FFI, there is an equally complex challenge of incorporating such criteria into the piloting and development of ICT applications in support of its conservation programmes in order to demonstrate that there is the potential for biodiversity gain.

In line with this thinking is a recent study conducted by the Overseas Development Institute (ODI), called 'Livelihoods Approaches to Information and Communication in Support of Rural Poverty Elimination and Food Security' (ODI, 2003). The key conclusions were that information and communications systems are most likely to improve livelihoods in rural areas if they: share costs appropriately; ensure equitable access to all; contain a high proportion of local or appropriately localized content; build on existing systems; build capacity; use realistic technologies; and build knowledge partnerships. These conclusions are wholly appropriate to FFI's conservation programme, whenever ICTs are being applied, as FFI considers

Box 5: Real Access criteria (to close the digital divide)

1. **Physical access**: is technology available and physically accessible?
2. **Appropriate technology**: what is appropriate technology according to local conditions, and how do people use the technology to suit their own needs and wants?
3. **Affordability**: is technology access affordable for people to use?
4. **Capacity**: do people understand technology and its potential uses?
5. **Relevant content**: is there locally relevant content, especially in terms of language?
6. **Integration**: does the technology further burden people's lives or does it integrate into daily routines?
7. **Socio-cultural factors**: are people limited in their use of technology, based on gender, race or other socio-cultural factors?
8. **Trust**: do people have confidence in and understand the implications of the technology they use, for instance in terms of privacy, security or cybercrime?
9. **Legal and regulatory framework**: how do laws and regulations affect technology use and what changes are needed to create an environment that fosters its use?
10. **Local economic environment**: is there a local economy that can and will sustain technology use?
11. **Macro-economic environment**: is national economic policy conducive to widespread technology use, for example, in terms of transparency, deregulation, investment, and labour issues?
12. **Political will**: is there political will in government to do what is needed to enable the integration of technology throughout society?
13. **Relevance**: any project interventions should have clear objectives that are relevant to people's needs.
14. **Using existing structures**: where appropriate, interventions should use what is available, but also adapt to changing environments.

Source: Adapted from Bridges.org (2003)

human livelihoods as a fundamental part of any conservation strategy.

3.3. Widening the scope: integration with other ICTs

Any analysis of the impact of mobile phones on conservation and development has to consider the wider ICT environment. Mobile phones are just one component of the range of telecommunications equipment on offer. Chapter 8 demonstrates a range of ICT tools available to those working in the conservation and development arenas.

At the same time, it is difficult to evaluate the impact of ICTs, including mobile phones, in the developing world, as contributors to the World Summit on the Information Society, in December 2003, have recognized:

> . . . despite the proliferation of reports, initiatives, and pilot projects in the past several years, we still have little rigorous knowledge about 'what works'. There are abundant 'success stories', but few of these have yet been subjected to detailed evaluation. There is a growing amount of data about the spread of ICTs in developing countries and the differential rates of that spread, but little hard evidence about the sustained impact of these ICTs on poverty reduction and economic growth in those countries . . . it is even difficult to put together systematic and reliable information on the size and scope of ICT initiatives in developing countries.
>
> McNamara (2003)

Finally, it is important to re-emphasize that mobile phones and other ICTs are only tools, and not the

solution to the problems encountered in the conservation and development arenas. In this respect, ICTs should be seen as tools of wider strategies and programmes, which aim to deal with threats to wildlife and the environment, as well as poverty. McNamara's paper outlined general principles to act as guideposts for ICTs to be used in the promotion of development and poverty reduction (McNamara, 2003). These can be adapted to be applicable, also, to biodiversity and conservation. The case studies that follow in Chapters 5–7 demonstrate how ICTs are used practically in development and conservation programmes.

The internet can be regarded as a powerful tool for change and as a result has become a core element of numerous ICT strategies. However, it is important to be aware of its negative impacts. These include propagating western ideologies and lifestyles; neglecting other cultures; delivering culturally-inappropriate content (*e.g.*, pornography); being heavily biased towards the English language (approximately 65% of the internet is in English); issues over security and personal data (including viruses, worms and spyware); almost total lack of regulation; distorting the truth and the lack of accountability; propagating racial hatred and other extremist views; information overload; and exposing unsuspecting individuals to internet fraud. As the mobile phone becomes a more sophisticated and complex technology, it will face similar dangers. It is necessary for governments and business to develop appropriate policies that can curtail the negative use of mobile phones and other ICTs.

ICT Strategies and Applications for, and in, the Developing World

4

4.1. Government and donor policies

Governments and donors have been considering the role of ICTs in development for a number of years. While some have been slow or cautious on the uptake of ICTs, others have fully embraced new technologies in their policies and programmes. For example, the New Partnership for Africa's Development (NEPAD) sees ICTs as crucial for social and economic development in the sub-continent. It has nominated organizations like Africa Connection to develop rural ICT markets, in order 'to create a positive business environment for attracting expanded private investment and new operators into telecommunication infrastructure and information technology, as key planks in a broader effort to foster socio-economic development and growth' (Africa Connection, 2003).

However, as with other multilateral ICT initiatives, NEPAD requires support from donors, civil society and the private sector. None of its twenty high-profile infrastructure projects (which includes tele-communications) has attracted a major private sector company in three years (NEPAD, 2004).

Most bilateral and multilateral donors have developed ICT strategies, recognizing the potential of ICTs as a catalyst for socio-economic development. They do not see ICT proliferation as the goal, but as a means to achieve their broader objectives, particularly in poverty reduction. Most donors have built their ICT strategy on partnerships with other bilateral and multilateral agencies, civil society, the private sector and academic institutions. A recent survey of OECD members concluded that:

- Sustainable ICT projects need to be locally owned and accompanied by human capacity development;
- Capacity in effectively using ICTs for development is often the main constraint, not equipment itself;
- The private sector is instrumental in expanding ICTs for development access and applications;
- Governments play a key role in establishing a well-regulated, competitive enabling environment for ICTs to flourish;
- For ICTs to have a positive development impact, the various social groups must have equal access to them, particularly disadvantaged groups such as the poor, [women], children and indigenous people;
- Many important aspects of information and communication infrastructure are cross-border in nature, and therefore require international/regional cooperation.

(OECD, 2003b)

These conclusions largely mirror the earlier arguments on the role that mobile phones and other ICTs can play in development and conservation work. The third point, referring to the crucial role of the private sector, is extremely important. In designing and implementing any ICT project, it is essential that governments and civil society work in partnership with the private sector, if they are to have real success.

The World Bank has developed an Information and Communication Technology Strategy with the vision "to be a catalyst in *improving access* to ICT and *promoting its use* for stimulating economic growth, increasing equity, and reducing poverty" (World Bank,

2002). In this regard, the World Bank and other donors have agreed Millennium Development Goals (MDGs), which commit the international community to an expanded vision of development, one that vigorously promotes human development as the key to sustaining social and economic progress in all countries, and recognizes the importance of creating a global partnership for development. Its ICT strategy is geared towards meeting these MDGs.

The World Bank's vision leads to four strategic directions: (1) broadening and deepening sector and institutional reform, (2) improving access to information infrastructure, (3) supporting ICT human capacity, (4) supporting ICT applications. InfoDev, which is a part of the World Bank, funds ICT projects that feed into the work of the World Bank's Global ICT Department. InfoDev itself acknowledges the need to review the support it has provided to ICT projects. As a result, in 2004–05, it is launching "an intensive programme of support, research, analysis, and evaluation, impact monitoring, and toolkit development focused on distilling the lessons and experiences from the past 10 years on the impact of ICTs on poverty . . . ." (InfoDev, 2004).

As with the World Bank, the United Nations supports a number of initiatives, including the UN's ICT Task Force (which involves NGOs, government and the private sector), the UNDP ICT for Development programme, of which the Digital Opportunity Initiative is a key component (a public private partnership), and Digital Diaspora Networks (for Africa and the Caribbean, up to mid-2004).

Of particular interest to this report is the policy of the Department for International Development (DFID) in the UK. A study in 2002 set out the fundamental principles for DFID's approach to ICTs and development. DFID supports a number of ICT-related programmes, including Building Digital Opportunities, Catalysing Access to ICTs in Africa, Imfundo (a programme to use ICTs for primary education and gender in Africa), Knowledge and Research, Louder Voices, and Open Knowledge Network. It also supports a number of multi-donor programmes, as well as companies like Vodafone, through its Business Challenge Fund.

It is important that the development and conservation community is informed of these wider developments. Equally, NGOs need to inform donors and governments of viable and appropriate ICT applications at the grassroots level. It is essential for any ICT project to understand the context in which it is working, and ensure integration with multilateral and bilateral programmes.

4.2. The role of non-governmental organizations (NGOs)

As with governments and donors, NGOs are beginning to see the benefits of ICTs to development and conservation work. Some NGOs have embraced ICTs in their programmes, while others remain somewhat sceptical. The case studies in the subsequent chapters demonstrate the former. One NGO that has led the way in terms of its support to ICTs in development is the International Development Research Centre (IDRC), based in Canada, which has, amongst other programmes, created the Acacia Initiative to support ICT projects in Africa. Trusts and foundations are also recognizing the importance of supporting ICT projects that can help to close the digital divide, such as the Open Society Initiative. Other NGOs such as Bridges.org have been involved in developing policy and lobbying governments to improve access to modern technologies.

There are various NGO consortia working with ICTs, as well as organizations set up specifically to deal with issues of the digital divide. One such organization is the Digital Divide Network, which involves a number of partners from the private and not-for-profit sector. The NGOs in Table 1 are just some of those involved in ICT for development and conservation.

4.3. Corporate Environmental and Social Responsibility (CESR): the business benefits of good practice

There are a myriad of reasons why companies adopt CESR policies and practices. These drivers cover a spectrum that ranges from damage limitation to market opportunism. While corporate responsibility reporting is increasingly a feature of annual accounting processes, there are marked differences between the policies and practices of different companies. CESR policies tend to be voluntary in

Table 1: Some NGOs active in ICT policy and practice

NGO	REGION/COUNTRY
Association for Progressive Communication	Global
Bhoomi	India
Bridges.Org	South Africa
Committee for Democracy in Information Technology (CDI)	Brazil
Digital Partnership	Global
Electronic Networking for Rural Asia/Pacific Projects (ENRAP)	Asia/Pacific
Geekcorps	Global
Grameen Phone	Bangladesh
Greenstar	Global
Gyandoot	India
Health Internetwork	Global
IndiaCares	India
Information Society Programme	Brazil
International Development and Research Council (IDRC)	Global
Learn Link	Global
One World International	Global
Open Knowledge Network	Africa
Quipunet	Peru
Somos@Telecentros	Latin Am./Carib.
TARAhaat.com	INDIA
Technology Empowerment Network	Global
TeNeT (Telecommunications and Computer Networks Group)	India
Youth for Technology Foundation (YTF)	Nigeria
Women's Net	South Africa

nature, so the amount of emphasis on CESR depends largely upon the CEO, executive board, key staff or shareholders. In general, the private business sector argue that this voluntary approach is bringing about results in practice, while others (*e.g.*, the corporate social responsibility coalition[7]) believe that there should be mandatory requirements that make regulation the key driver.

Whether by choice or compliance, good corporate behaviour makes good business sense because:

- Detrimental environmental practices can cost time and money, and pose serious financial and regulatory compliance risks for companies. Anticipating and managing these risks delivers clear corporate benefit;

[7] *This is a UK coalition, of whose members include NGOs, academic institutions, unions, business, and MPs. FFI is not a member of the coalition. It calls on the Government to ensure that companies to meet their environmental, social and business duties in three key areas: (a) mandatory reporting, (b) directors' duties, and (c) foreign direct liability.*

- Poor environmental practices pose health and safety risks for employees, host communities and customers with resulting legal and financial implications for the company;
- Poor community relations can jeopardize a company's 'licence to operate';
- Public campaigns that can have significant negative impacts on reputation and brands are less likely if a company adopts good practices and open communications;
- A good social and environmental track record can improve a company's performance on corporate indices, as well as its access to capital, as financial institutions and investors will feel more confident about the security of their investment;
- Companies with stated and demonstrated values, as well as active social and environmental outreach programmes, find it easier to recruit and retain quality staff;
- Products and services that answer environmental and social needs may be good indicators of innovative applications and potential new markets.

4.4. How the telecommunications industry can address its CESR responsibilities

As for any sector, these broad drivers of good practice can be applied to mobile telecommunications companies. There are many generic environmental management issues that companies should monitor, including energy efficiency, transport and water consumption. But a variety of industry-specific issues also need to be considered.

4.4.1. Environmental impact of network rollout

The siting of base stations is a major consideration for mobile telecommunications companies as the aesthetic and potential health impacts of masts are highly contentious issues. Some companies are working with local planning authorities to find ways to balance the demands of service delivery with local concerns and restrictions. It is good practice for companies and local authorities to engage fully with the community, including local environmental bodies. This is especially true of mast locations, particularly in relation to health and more specifically when they are located above public buildings and schools. Despite a series of health studies that have been carried out by government, academia and the mobile phone industry, results are inconclusive.

4.4.2. Waste management/end-of-life product control

An estimated 15 million mobile phones are replaced each year in the UK alone. Many end up in the waste stream where, along with chargers and particularly batteries, they create a potentially lethal pollution hazard. International legislation is driving companies to build appropriate waste management policies and practices into their business operations with the result that recycling programmes are even starting in emerging markets such as Nigeria. These recycling programmes are a lucrative industry in their own right, providing the twin benefits of waste management and introduction of cheaper products to emerging markets.

4.4.3. Supply chain management

A company's efforts to improve its own performance may be seriously undermined if it is found to be trading with, and profiting from, other companies whose socio-environmental actions are unacceptable. Managing the supply chain has become a major area of concern for many sectors including telecommunications. Addressing the complexities of the supply chain can often be most effectively achieved as a group rather than on an individual company basis. In order to share responsibility, learning and costs, the telecoms sector has created several industry policy development forums, including the Global e-Sustainability Initiative (GeSI). However, there is still much to be done on supply chain management. The industry should engage more with governments and civil society to ensure that ethical practices are carried out and monitored right down the supply chain.

An increasing number of companies within the sector now produce annual CESR reports. Orange has been developing its CESR policies, publishing its first report in 2003, stating that: "corporate social responsibility is a natural extension of our business philosophy, brand and values" (Orange, 2003). Orange has eight business principles, including a commitment to managing its environmental impacts responsibly. As with mmo2, which is supporting the

Box 6: Fonebak

Through the 'Fonebak' scheme, Shields Environmental collect mobile phones for reuse or recycling. Viable phones are tested, refurbished, rebranded and sold. Older phones are recycled and the metals – including gold, palladium, copper, silver and platinum from the handsets, and cadmium, lithium and nickel from the batteries – are reclaimed. Plastics are recovered and reused, or cleanly incinerated for energy generation.

Typically, Fonebak recycles phones that are 1-2 years old, and which are then used for a further 3-5 years in a developing market. So by moving between markets, these phones actually fulfil the 7-year lifespan committed by the manufacturer rather than being obsolete after a mere 18 months use in the developed world.

Box 7: The coltan issue

In 2000, the telecommunications industry was accused of profiting from the war in Central Africa through the purchase of cheap 'coltan' – an ore containing the metal tantalum used in electronic products including mobile phones.

In an effort to understand the issues and address the problems, GeSI worked with FFI to propose an ethical trading response.

Source: Hayes & Burge (2004)

planting of new forests in Europe, it supports charities through its Community Futures programme. These are worthwhile initiatives, but could be expanded. Orange encourages each of its companies to work with charities and support educational initiatives including how mobile phones can help in education, *e.g.*, providing Thai language text messaging to deaf people in Thailand.

Partnerships are being formed between companies and the NGO sector. NGOs are able to add value to an organization by drawing on external resources, opinions and perspectives not available internally, and in return companies can provide specific skills, staff and expertise not available to NGOs. In some cases, these relationships are sponsorships or cause-related marketing campaigns. In others, the partners share resources and skills in order to address social and environmental issues within the sphere of the businesses' activities. An example of the latter is the relationship between FFI and the Vodafone family of operating companies and corporate foundations. The parties are working together on a range of these issues in order to see how mobile telecommunications affect communities and environments and how this can bring about biodiversity gains.

A partnership between the NGO and business sector needs to recognize that each party has different goals and objectives. A technology business may be most interested in how to gain access to emerging markets and sell more products, while an NGO's prime concern may be to determine how a technology could be applied to poverty reduction programmes. It is important for both parties that the NGOs avoid being compromised as this will impact negatively on both their credibility with their supporters and on the impartial value they deliver to the company. They must be prepared to monitor and challenge their business partners. Key lessons on how companies and NGOs build effective partnerships can be found in the publication 'Getting Real' (IBLF, 2002).

Companies are accountable not only to their shareholders, but to customers and communities in which they have an impact. Likewise, NGOs should be accountable to both donors and the communities in which they work. It is good CESR practice for a

company to respond positively to challenges and concerns as this process will strengthen and validate CESR policies.

4.5. Connecting CESR and market opportunity to extend coverage to poor, rural areas

> Senior managers who commit their companies to strategies for the bottom of the pyramid are creating sustainable development…
>
> Prahalad and Hart (2002)

With telecommunications markets reaching saturation point at the 'top of the pyramid' in developed countries, companies are turning their attention to the potential at the 'base'. An estimated four billion people worldwide occupy this space – defined as having a purchasing power of less than US$1,500 a year. Whether as a component of CESR policy or identified as 'emerging markets development', many companies are beginning to see the benefits of this "counterintuitive new opportunity in the new millennium" (Prahalad and Hart, 2002).

In terms of economies of scale, servicing the base of the pyramid clearly makes sense. As previously documented, mobile phone uptake has proved strong in many developing countries, despite the preconception that the cost would be prohibitive for the majority. This large and willing market creates an incredibly high rate of demand and potentially very attractive profit margins within a relatively short period of time.

As the limiting factor is coverage, investment in infrastructure is substantial. However, outside well-populated urban areas, developing countries may present vast landscapes with scattered, small centres of habitation that pose significant physical and technical challenges in terms of coverage as well as marginal financial return, if any.

Anxious to try to extend coverage into these rural areas, some governments, when granting operating rights, require companies to include investment in areas of marginal return. Thus some network operators are committed to extending mobile coverage to isolated and unprofitable populations. In such situations, the companies are, in effect, providing subsidized telecommunications services to some of the poorest communities.

But this does not necessarily constitute CESR as much as enlightened business interest. Such 'subsidies' are, in fact, a precondition, and therefore a cost, of their licence. And there is a significant market at stake. Cumulatively, the revenue potential in Africa's rural telecom and ICT markets is estimated to be US$3 billion (Africa Connection, 2003).[8] There is, therefore, great financial potential in this dispersed market if companies can find creative solutions to make investment in infrastructure commercially viable. This may require partnerships with governments and co-operation between mobile phone companies in order to share costs.

In some instances, the government further requires the company to make social investment commitments to poor urban and rural communities, and to environmental causes. This is most notable in South Africa, where the three main cell operators (Vodacom, MTN and Cell C) are required not only to build networks in rural locations but also to include the provision of public phone booths. But, again, there is potential for commercial return. In Tanzania, the government has required Vodacom Tanzania to set up 50 telekiosks through a franchising system. The same company is now setting up its 200th centre, "not least because high demand has made telekiosks a profitable business idea" (Dialog Online, 2003).

Africa Connection has produced a Rural ICT Toolkit aimed at those looking to accelerate rural ICT development in Africa. It recommends four main activities to be promoted: (1) rural public phones (including the [mobile] 'Virtual Network Operator'), (2) regional 'next level' internet points of presence (POPs), (3) networks for rural 'intermediate' agencies, and (4) small-scale telecentres.

4.6. Socio-economic spin-offs: mobile telephony as a catalyst

In the often highly entrepreneurial environments found in many developing countries, the arrival of

[8] *The World Bank financed a study, with the Africa Connection Centre for Strategic Planning, in 2003 showing the market potential for ICT development in rural areas, in 10 African countries.*

mobile phones has many spin-offs. This 'organic growth' effect has stimulated the creation of all manner of small, micro and medium enterprises (SMMEs) offering a wide range of services to the new mobile owner including phone charging, top-up voucher sales, repairs, new covers and phone rental.

It is not only the mobile phone operators that are seeing the benefits of reaching out to so-called 'uncommercial' targets. In India, a local mobile phone service provider has offered a mobile phone service (phone, battery, billing machine, printer) to 200 cycle-rickshaw drivers, many of whom are women and/or disabled people. For each call one of their customers makes, the rickshaw driver earns a 20% commission (InfoChange, 2003). In Ghana, some areas are unable to receive mobile signals due to the topography, so 'cell phone towers' have been built by local entrepreneurs from wood and stones, and mobile users are charged to climb the tower and make a call (Hall, 2003).

4.7. A southern African perspective

In 2003 FFI carried out extensive research with its partner organization, ResourceAfrica, into the potential for mobile phones and other ICTs to support conservation and development initiatives in southern Africa. According to the research, South Africa and Mozambique were seen to be two countries where mobile phone technology could have such an impact. It is important to recognize at the outset that South Africa has a strong comparative advantage over the rest of sub-Saharan Africa, in terms of its tele-communications infrastructure, business and financial environment and skills base. In contrast, Mozambique has less well developed infrastructure and a much smaller business environment.

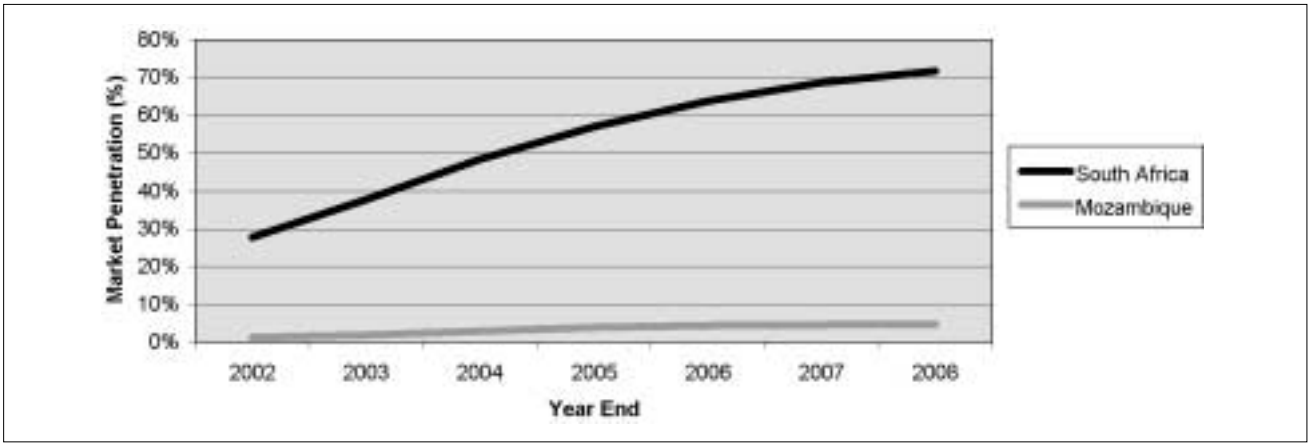
FFI commissioned independent research, which revealed the following key findings on the mobile phone networks and usage in these two countries (EMC, 2003):

- A key area of government communications policy in Mozambique and South Africa is developing universal access to telephony services (wireline and wireless). The nature of wireless infrastructure makes cellular telephony an attractive option for rural deployment;
- This commitment necessarily means building networks in rural locations that otherwise would not be built for commercial purposes;
- In both Mozambique and South Africa, the rollout of Universal Services is funded by the operators through a contribution of 2% of annual turnover;
- In Mozambique, licensees have not yet committed any funds and are awaiting ministerial approval of a new telecom bill before so doing;
- In South Africa, the commitment to Universal Services was capped at ZAR20 million per annum, but from April 2004 will move towards 2% of annual turnover of the operator;
- Competition in the mobile sector is seen as inductive by both regulatory authorities as lowering entry costs for tariffs and handsets;
- South Africa has three GSM operators; the third, Cell C, launching seven years after MTN and Vodacom;
- Mozambique has an existing GSM operator, state-backed mCel, with a new licensee, Vodacom, expected to launch GSM services in the first quarter of 2004;
- Literacy rates are not seen as a hindrance to take up of mobile services, although limited usage on SMS and some data services is to be expected for the illiterate population. No operator mentioned the possibility of using picture messaging as an alternative content service for this portion of the market;
- Content services are available in limited local languages. Cell C offers customer care service in the 11 South African official languages, but Sotho content services are not yet available to service members of the Limpopo Province;
- As expected, the South African market is more developed than that of Mozambique and at the third quarter of 2003 had reached 30.5% penetration versus 1.8% in Mozambique (see Tables 3 and 4);
- SMS is the only data service available in the Mozambique market at present;
- SMS, WAP, GPRS and Multimedia Messaging Service (MMS) are all available in the South African market, although new entrant, Cell C does not yet offer all these services;
- SMS usage in South Africa is comparable with European levels in terms of penetration and usage per month;

- There has been little development in micro payment services in either Mozambique or South Africa. Operators gave a mixed response to the future of micro payments;
- All operators indicated handset costs as a cost hindrance for increasing cellular penetration among lower income sectors of the community;
- In Mozambique, Vodacom has been arguing for a lifting of import duties imposed on handsets, but remains unsuccessful in convincing the authorities that handsets are a basic communication tool rather than a luxury item. This despite the fact that mCel and the regulator, INCM also acknowledge the issue.

The research indicated that, in South Africa, 96% of the population live within areas that have mobile phone coverage (see Tables 3 and 4). The remainder live in remote rural areas. For example, coverage does not extend beyond the borders of the Kruger National Park. In the next five years, it is predicted there will be nearly a 100% increase in the uptake of mobile phones, despite the fact that many potential subscribers may not have the means to afford handsets and pay monthly line rental, where applicable. In response, companies such as Vodacom are taking steps to bring mobile telephony to all South Africans, with its roll out of subsidized community telephones. It is clear that in South Africa, at least, the mobile phone will become a more dominant

Table 2: Cellular market indicators



Tables 3 and 4: Current and future trends in mobile phone coverage and services

CELLULAR MARKET INDICATORS	YE 2002	YE 2003	YE 2004	YE 2005	YE 2006	YE 2007	YE 2008
South Africa							
Total Market	12.09m	16.12m	20.57m	24.19m	26.89m	28.65m	29.65m
Penetration	27.8%	37.7%	48.3%	57.0%	63.8%	68.6%	71.7%
Mozambique							
Total Market	0.24m	0.32m	0.52m	0.69m	0.79m	0.83m	0.84m
Penetration	1.2%	1.8%	2.9%	3.9%	4.4%	4.6%	4.7%

Source: EMC World Cellular Database, from: EMC, Nov 2003, Research into Mobile Phone Usage in Mozambique and South Africa

CELLULAR SERVICE LAUNCHES	GSM	WAP	GPRS	MMS
South Africa				
Cell-C	Nov 2001	n/a	n/a	n/a
MTN	Jun 1994	Available	Oct 2002	Oct 2002
Vodacom	Jun 1994	Available	Oct 2002	Oct 2002
Mozambique				
mCel	Nov 1997	n/a	n/a	n/a
Vodacom	Q1 2004	n/a	n/a	n/a

Source: EMC World Cellular Database, from: EMC, Nov 2003, Research into Mobile Phone Usage in Mozambique and South Africa

information and communication tool over the next decade. This could result in the use of mobile phones in conservation areas, including some national parks.

The situation in Mozambique is quite different. There is very limited coverage, mainly in the urban areas, although this is likely to change significantly with the increased competition from other mobile phone operators. Unsurprisingly, many conservation-based projects and national parks are not yet in areas with mobile phone coverage. Communities living in and around these areas, such as the Niassa Reserve, are in danger of being left further behind in the digital divide, unless there are serious attempts to provide capacity and resources. Due to the predicted network expansion in Mozambique (as shown in Table 3), it is possible that there will be mobile phone coverage in the future although the growth in penetration rate is anticipated to be relatively slow (only 4.7% by 2007). A wide range of ICT alternatives have to be considered, as well as developments in the mainstream ICT sector (including the viability of expansion of mobile phone coverage into conservation areas).

Mobile Telephony and Development: Case Studies from around the World

5

It is fair to say that bespoke mobile phone applications aimed at specific industries or activities are few and far between. The mobile phone is still primarily used as a voice communications device despite the efforts of network operators to encourage increasing data traffic. Short Message Service (SMS), a huge success story for the industry with an estimated one billion messages sent every day around the world, was initially developed for use only by service technicians. Its potential for mobile phone users was not realized until later, and its implementation was somewhat 'accidental'. Although mobiles have come a long way in recent years with the provision of WAP and now 3G, plus the additional functionality of calculators, calendars, metric conversion applications and games, evidence of specific work-based applications beyond WAP-centric information services are rare. It therefore comes as no surprise to find that the tailoring of mobile phones specifically to conservation and development work is still very much in its infancy. Evidence of mobile phone use in these two fields is, indeed, very sketchy. It is with the continuing convergence of mobile and Personal Digital Assistant (PDA) technology where the opportunities for the industry are perhaps at their greatest.

If introduced appropriately, mobile phones can be a useful tool for development.

The following are just some examples where mobile phone technology is being applied in development projects around the world.

5.1. Rural phones

For the first time in their history, many parts of the developing world are being connected through the provision of mobile phone technology. This is having a significant impact on people's lives as they are used not just for basic communication purposes, but also for rural development. One of the leading exponents in the use of mobile phone technology for poverty alleviation is Grameen Phone in Bangladesh (see Box 8). This emerged out of the experiences of the Grameen Bank, which has successfully promoted microfinance initiatives with mainly poor women in rural communities throughout Bangladesh. Grameen Phone's Village Pay Phone model has led to the expansion of mobile telecommunications in rural communities. As a result, Grameen Phone has become a successful privately-owned company in its own right. Equally, it has helped to empower poor communities, in particular women, by increasing incomes, providing business opportunities and acting as a catalyst for community development. Partly as a result of the reported achievements of Grameen Phone, the model has been replicated in various forms elsewhere in the world.

For example, the Rural Phone Network (RPN) has been piloted to "bring together the resale of wireless air-time for public access and micro-finance to establish a network of village public telephones to extend reach and impact of GSM mobile networks in both 'near rural' and 'deep rural' localities of Nigeria" (InfoDev, 2003a). Implemented by Intelecon, the

project investigates the commercial and market prospects of micro-finance through the RPN. The pilot project is focused on women's groups in three locations, bringing together NGOs and the private sector. In other countries, the concept of rural phones has not been based on the Grameen Phone model, although there are similarities.

There are some concerns. The rural mobile phone networks are dependent upon mobile phone operators extending coverage to the rural poor. They are not necessarily integrated with other ICTs, in particular national landline networks. Moreover, without appropriate recycling schemes in place, there is a danger of pollution caused by the disposal of end-of-cycle handsets.

5.2. Telemedicine

Mobile phone technology is also being used to support the health sector. The direct nature of mobile telecommunications is enabling doctors to communicate with patients in a cost-effective and time-efficient way. It can also save the patient a considerable amount of lost time in travelling to and from a health clinic. For example, in South Africa, an initiative called On-Cue Compliance was set up to

Box 8: Grameen Phone, Bangladesh

Village Pay Phones is an initiative of the Grameen Bank aimed at reducing poverty through the economic empowerment of women in rural Bangladesh. The Grameen Group set up Grameen Phone, which manages the entire phone system, operating the GSM network and lending money to village women to purchase GSM cellular phones. Phone owners rent the phones to village farmers and other community members for a fee and also provide messaging and incoming call services.

Grameen Phone's goal is "to connect rural Bangladesh through the provision of a mobile telephone service by creating micro-enterprises that can both generate individual income and provide whole villages with connectivity." The impact of Grameen Phone is said to have been:

- Phones have been placed in 1,100 villages. The 6–7 year goal is to serve 500,000 subscribers, including 68,000 phones dedicated to serving rural areas;
- Village Phones have increased incomes and savings accumulation among phone owners, mostly women. It is estimated that income from Village Phone operators comprises about 24% of the average household income, and even 40% in some cases;
- Phone users, mainly local farmers, have increased their productivity through access to market information, weather reports and pest and disaster alerts;
- Farmers in phone villages receive up to 10% higher prices for farm products and improved security of supply for inputs;
- A significant portion of phone owners' profits have been spent on paying for improved education and health services for their families;
- The phone service has also contributed to improvements in disaster response, crime rates and livestock mortality through better access to public services.

Despite its successes, there are said to be a number of challenges. While Village Pay Phones is a model for community development, the Grameen network is not integrated with the national fixed line network. This is due to telecommunications regulation in the country, which, to a large extent, is being challenged by the rapid expansion of Grameen Phone. The wireless technology chosen by Grameen, based on well-known international standards, is expensive and not optimal for rural areas. Service quality has been inconsistent among phone owners and may have a negative impact on customer satisfaction.

Sources: World Resources Institute (2001) and www.grameenphone.com

send text messages to remind patients to take their medication. Targeting mainly tuberculosis sufferers, they pay about £0.85 per month to receive a message every day. The service has been extended to provide basic health care information and advice. Concerns about the fact that lower income patients would not be able to afford mobile phones have been discounted chiefly due to the availability of pay-as-you-go.

Telemedicine services such as this provide a new means of accessing information for both patients and health staff. There is evidence that mobile telecommunications can assist in recording information to improve health management, including the monitoring of diseases (*e.g.*, Voxiva health support in Peru (InfoDev, 2003b)). They can also target individuals more easily. However, whilst they may be a cheap way of tackling very basic health care issues, mobile phones can never replace a nurse or doctor.

5.3. Small business development

Increasingly, mobile telecommunications are being introduced by NGOs to aid small business development. Not only have they provided small businesses with direct access to their markets, they have also furnished numerous other benefits such as helping to market products and negotiate prices. Additional business opportunities have opened up in the mobile service industry, with traders selling top-ups, charging batteries and offering repairs. For small business development to benefit fully from the 'added value' opportunities that mobiles phones offer, locally relevant content is crucial. The example shown in Box 9 below is a good example of information delivery based on local needs.

In 2001, in Chennai, India, an international NGO, FOOD began providing women's groups with a mobile phone to facilitate contact between production and marketing groups, and between groups and customers (InfoDev, 2003b). In some cases, mobile phones have been introduced alongside other ICTs. For example, Sonke, an organization promoting tourism development in the townships of Cape Town, South Africa, is assessing how ICTs (primarily PCs, the internet and mobile phones) can be used by communities to market and sell their products and tourism trips to the townships (IDRC Reports, 2003b).

5.4. Market trading and farming

It is worth highlighting a specific area of small business development – market trading and farming – to which a number of developmental NGOs and private companies have paid particular attention. It is here that some of the most innovative mobile phone applications have been developed, and integrated with other ICTs, particularly the internet (both web and WAP). The most notable examples are an

Box 9: One World International (mobile content to change lives), Kenya and South Africa

The Open Knowledge Network (OKN) project is being funded by the Vodafone Group Foundation to establish a mobile content service (SMS and vocal) to deliver information based on what local people need and want (in areas of health, agriculture and education) to local small businesses and poor families in Africa. Initially, the project is being piloted in Kenya, South Africa and Uganda. The objectives are to: (1) provide timely, appropriate and relevant information via mobile phones, (2) create a sustainable business model, (3) integrate evaluation to ensure continuous improvement and appropriate development, and (4) scale up across 16 countries in the first three years (2004–06). The activities include market research, prototype development, product demonstration, product testing, and product evaluation and reporting. The potential benefits include strengthening local community economic development, creating economic advantages for individuals through provision of timely and accurate information, and improving opportunities through provision of relevant local knowledge.

Source: Vodafone Group Foundation (2004)

Box 10: Farmers and traders, Uganda

Since 2003 the National Agricultural Advisory Services unit has been piloting 'localized market information services' in six districts. Designed to meet the needs of local farmers and small-scale traders, mobile phone networks and FM radio stations are being used to receive and disseminate information such as prices, volumes, markets and crop conditions. This is done through local languages (on FM radio stations), with price fluctuations transmitted via SMS.

Source: Foodnet (2004)

Box 11: Market traders and farmers, Senegal

Manobi-Senegal is a joint venture between Senegalese and French entrepreneurs, which uses teams to gather information about prices of foods and goods being sold in Dakar (the capital). Farmers have tended not to know prices or demand and supply levels at the market place, having to rely upon middlemen who exploit the situation for their own benefit. However, Manobi independently collects prices (of a variety of foods) and uploads them to its central database using mobile phones that dial into a server via WAP. The farmers in the field use their mobile phones to check prices before they set off and to find out where they will receive the best offer for their produce. Manobi is piloting this scheme with some 150 people, including farmers, importers and fishermen. Manobi is talking to organizations that represent more than 250,000 people who work in Senegal's agricultural industry.

The piloting appears to have been successful, as Manobi-France and SONATEL have now launched the system, which is based on a Multi-Channel Service Platform: a "unique multi-modal technological platform that adds multi-channels data functionalities in the network of the mobile operators . . ." (Balancing Act, 2003a). It combines the internet and the mobile, providing information to people in the fishing and agriculture sectors. The user can obtain the following types of information: (1) markets and products, (2) communication (email, news), (3) sales (market places), (4) supply (product price lists, online purchases), (5) professional assistance. It appears to be targeting entrepreneurs, although cooperatives and farmers' groups are not necessarily excluded. Poverty targeting? Manobi argues it is helping in the "development of new uses suited to the local needs".

Manobi (headquarters in Montpelier) is a French-Senegalese team specializing in telecommunications, internet and agro-industrial markets. The company deploys its multi modal platforms (WAP, SMS, MMS, iMode, Web) and terminals (mobile phones, PDA, PC) in developing countries and Europe "in order to establish interactions through the mobile networks and the Internet among the professionals of the agribusiness sector."

Sources: BBC NewsOnline (2002a), Manobi (2004), Balancing Act (2003)

e-marketplace in the Philippines, which assists farmers and fisherfolk (InfoDev, 2003b), farmers and traders in Uganda (see Box 10), and market traders and farmers in Senegal (see Box 11). Central to these initiatives has been the provision of market prices and information such as transportation costs to small-scale producers and traders, leading to the creation of a level playing field. This has allowed electronic buying and selling of (mainly food) products. It has the potential to improve household and community incomes by shifting the balance more in favour of the producer (cutting out the middle person). However, it is too early to assess the impact of these initiatives on the poorest as there is some concern that some projects have only focused on middle-income people. Nevertheless, the benefits to poor communities are only evident if they have access to affordable mobile phone technology.

5.5. Humanitarian and community services

Mobile phones are being used by development organizations to bring people together. There are numerous examples where the technology has helped in community reconciliation projects. Childnet International (Vodafone Group Foundation, 2004) is using the latest mobile phone technology in an innovative way to help young people from different cultural backgrounds to share information about their history and culture. The goal of the project is to demonstrate how new mobile phone technology (including WAP and photo-messaging) can be used to encourage children to share their own history and culture, and challenge age-old perceptions and conflict. The focus will be communities in Ireland (in 2004) and Hungary (in 2005).

Increasingly, mobiles are being used in support of humanitarian aid projects. Telecom Sans Frontieres, for example, uses a range of telecommunications equipment and applications to support disaster relief programmes (Vodafone Group Foundation, 2004). Mobile technology can be ideal in areas where landline infrastructure has been damaged or where there are high numbers of displaced persons. They have the potential to be used for location-based services in finding missing people, and integrated camera phones can be used to catalogue and transmit images of lost children. However, the mobile phone is still a tool as it cannot replace actual dialogue. Its use is also dependent on the availability of mobile phone coverage in disaster stricken areas.

5.6. Issues raised

Mobile phones are clearly seen by some as a useful tool in development. The most successful examples are where mobiles are being used to enhance existing development activities. This is clearly the case in the use of mobile phones to support farmers and market traders, as well as rural women's groups. It is crucial, however, that mobile phones remain affordable to people, as there is a danger that some may become more indebted if they invest in a technology that does not generate additional income.

The mobile phone is an excellent tool for people who simply need to make voice calls, but it may be less relevant in terms of SMS alerts if information is not delivered in a local language. In some development contexts, where there are high levels of illiteracy, ICT applications may be further limited unless there are appropriate training and literacy programmes.

In many cases the mobile phone has been integrated with other ICTs, especially the internet, which confirms the proposition made in Chapter 3 that the mobile has to be considered as part of a wider ICT family.

The mobile phone is only a relevant tool in areas of network coverage. Although rural phones are clearly having an impact on communities that had no access to telecommunications in the past, potential areas of operation are restricted by lack of signal. Solving this depends largely on whether the mobile phone company sees a business case for extending its coverage to these areas – areas which may not be seen as 'commercially viable'. There is, therefore, an impetus for development agencies to present business and development cases to mobile phone operators. In some countries, such as South Africa, there is both political will and a macro-economic environment that is favourable towards coverage expansion. In others, these conditions may simply not exist.

One of the questions raised by some of the case studies is centred around sustainability, given that most projects are dependent upon external funding and external expertise. This is clearly a concern for development agencies, as it is pointless bringing in new technology, or a new application, that cannot be sustained by local community groups or the local environment. With one or two case studies, it is unclear whether the mobile phone is seen as a tool or a solution within the development project, when in fact there could be more appropriate and affordable technologies around. The Grameen Phone is an exception. It is building upon an existing development model that is rooted in the communities. Ultimately, there still needs to be a viable local economic environment in order for these initiatives to succeed.

For many of the case studies, it is still too early to measure the impact of the mobile phone on poverty reduction, or indeed other development goals.

Mobile Telephony and Microfinance[9] 6

In one particular area of development – microfinance – mobile telephony is being introduced and piloted extensively. The previous chapter provided some examples of mobile phone use in projects based on a microfinance approach. Grameen Phone and the Rural Phone Network, for example, are in effect part of larger microfinance programmes. In those cases, mobile phones are being used in a typical way – making a call – that generates income for the 'owner' (who pays for the phone on credit).

At the same time, the corporate sector has seen the potential value of using mobile phone technology for commercial applications in the microfinance sector. These are profit-making ventures, although all are being developed in partnership with established microfinance institutions, as well as commercial banks. Moreover, they could have enormous development value in looking at how technology can benefit individuals, community groups or cooperatives.

The involvement of the private sector in microfinance is interesting. The technology being tested relies upon significant funding and commitment, and certain corporations are willing to make such investments driven by both CESR and commercial interests in emerging markets. If the introduction of new technology can improve the microfinance environment, and reach those who have not previously benefited from microfinance, then there could be real benefits. The fact that microfinance institutions (MFIs) have engaged with corporations such as Hewlett Packard and Vodafone provides an indication of the potential gains envisaged by the development sector.

6.1. Case studies

The following two case studies are examples of where mobile phones are being tested or introduced to assist with actual financial transactions in microfinance programmes.

6.2. Issues raised

Microfinance is clearly an area of development where mobile phone technology is being used, or at least piloted. The two case studies have highlighted the opportunities for the mobile phone to be used for more than just calling and texting. While both projects are still at an embryonic stage and the technology is only being tested, the potential for mobile phones to facilitate micro-payments could have significant benefits, while raising some concerns, for development and conservation projects. If micro-payments can be made via the mobile phone handset, albeit with some additional hardware and software, this could facilitate small-scale trading for agricultural cooperatives, selling and marketing of products for eco-tourism (which encourages natural resource management), and so on.

However, business is also interested in the commercial gains to be had from enabling people to make micro-payments using mobile phone technology. The

[9] *Microfinance involves providing very poor families with very small loans (microcredit) to help them engage in productive activities or grow their tiny businesses. Over time, microfinance has come to include a broader range of services (credit, savings, insurance, etc.) It is now realized that the poor and the very poor who lack access to traditional formal financial institutions require a variety of financial products (www.microfinancegateway.com)*

Box 12: Mainstreaming microfinance in Uganda

Hewlett-Packard has set up a Microdevelopment Finance Team (MFT), which is a consortium of microfinance leaders, technology specialists and business thinkers. The MFT will undertake product innovation, consortium building and pilot testing for a Remote Transaction System (RTS) in Uganda. The RTS is a combination of technology (including point-of-sale devices, such as the mobile phone, which communicate over a GSM network) and business processes that will enable cash deposits and withdrawals by microfinance clients through a network of accredited agents, including third-party merchants, in mainly rural areas. It is seen as creating the first part of a three-module 'transaction processing backbone'. The RTS will also facilitate the electronic capture of transaction data at the client level for MFIs and other stakeholders. The Uganda pilot will test the RTS technology, and the operational/ collaborative processes required. It is the view of Hewlett-Packard that, if this pilot is successful, the RTS model will be made available to the financial community so that it can be replicated in other countries.

The members of the MFT are: Hewlett-Packard Company, ACCION International, Bizcredit, LLC, FINCA International, Freedom from Hunger, echange LLC, Grameen Foundation USA and PRIDE AFRICA. This 12 to 18-month project started in mid-2003. The expected reach of the pilot is several thousand clients and three MFIs, each testing a different business model. Published results from the pilot are expected in the first quarter of 2005.

Source: Hewlett Packard (2004)

Box 13: increasing connectivity for microfinance in Kenya and Tanzania

With a grant from DFID's Business Challenge Fund, Vodafone UK will aim to enable 'increased connectivity' in the Kenyan and Tanzanian microfinance sector, by providing a data communication platform that will allow financial institutions to grow their business. Due to the limited fixed-line coverage in the countries, mobile phone networks will be used to facilitate financial transactions both quickly and securely across dispersed and remote populations. A project consortium is being put together, comprising telecommunications companies (including Safaricom and Vodacom), commercial banks and microfinance institutions. Specifically, Vodafone and its partners have experience to bring:

- Secure data applications that enable financial transactions over cellular networks;
- Data protocols that allow payment collection, credit control and account reconciliation in real time;
- Applications that deliver improved authentication;
- Experience in applying storage value technology to allow remote fund transfers;
- Innovative 'm-commerce' models;
- Good geographical GSM cellular coverage.

The initial stage of the project ran from October 2003 to mid 2004 with a pilot project extending until 2005.

Source: Vodafone (2004)

business sector and the development sector may view 'micro-payments' differently. Some microfinance programmes may move away from having a pro-poor orientation as they seek new customers in a move to 'commercialize' microfinance. This may challenge some of the more traditional microfinance institutions, which have wider developmental goals, largely based on meeting the needs of the poorest. These two approaches are not necessarily conflicting, and may indeed be mutually beneficial.

Potential barriers to the use of new technology for financial transactions are those of trust and socio-cultural factors. Part of the testing and development will need to provide understanding and build confidence amongst users. This is indicated in studies conducted by FinMark Trust, which is dedicated to making financial markets work for poor people in southern Africa. In 2003 the FinMark Trust conducted a survey of attitudes towards banking. In 2004 it is planning to support microfinance institutions that are interested in making use of mobile phone technology to test and develop appropriate tools in order to allow microfinance to reach the poor.

Such projects will depend upon existing infrastructure and mobile phone coverage. This may in turn lead to a widening of the digital divide, as business and microfinance institutions will understandably look to carrying out testing and development in areas where infrastructure and coverage already exist. However, if there is a proven application that assists the poor, there could be a business (as well as CESR) case for expanding coverage into less affluent areas.

Mobile Telephony, ICTs and Conservation

7

7.1. The use of ICTs in conservation

Due to the isolation of many conservation areas mobile phone use is often restricted. Where use is possible, it tends to be on a practical level only, providing simple but crucial voice communications. Hence there is an even more persuasive argument for considering other ICTs (see Chapter 8).

ICTs can be used to benefit biodiversity and conservation in a number of ways. The combination of remote sensing technologies and communications networks can significantly improve monitoring of environmental conditions and natural resource stocks. They can also permit early warning of, and prompt response to, environmental emergencies. Increased awareness of and access to sustainable approaches in agriculture, forestry and extractive industries can reduce environmental strains. 'Cleaner' technologies in industry and agriculture can reduce pollution and lower consumption of energy, water and other resources. ICTs can also improve the monitoring of environmental abuses and the enforcement of environmental regulations, and empower citizens' groups to participate in this monitoring and enforcement. More generally, ICTs can help disseminate knowledge and raise awareness of environmental issues and sustainable livelihoods.

Just as the mobile phone has improved communications in the field at a very basic (but crucial) level, many other ICTs, such as the personal computer, have contributed to conservation by improving administrative efficiency and providing a standard medium for information sharing and dissemination. However, when it comes to specific conservation-based ICT applications the computer industry has been slow off the mark. With the exception of applications such as Geographical Information Systems (GIS), and the Animal Record Keeping System (ARKS) used by many zoos around the world, there are remarkably few examples of specific conservation-based software applications (when you exclude standard databases and spreadsheets, for example). There is clearly a need for further conservation-oriented investigation if ICTs are to be used to their full potential in this field.

There are biodiversity gains to be made from the use of appropriate technology, as outlined in Table 5.

Increasingly, ICTs are being used in a range of conservation projects and in a number of ways. Some make use of specific ICTs, while others have taken a wider, more integrated approach. Furthermore, the level at which these ICTs are implemented varies widely, ranging from use at a simple, basic level (for example mobile phones for basic voice communication) to the integration of ICTs more fully into the heart of their projects (for example, they may use an ICT for core data collection, or for monitoring, evaluating, mapping and transmitting those data). In each of these cases, the level of research and development required to get the project 'ICT ready' tends to correlate directly with the level at which they are used or implemented.

It is worth pointing out at this stage that, due to the rate of innovation in the ICT industry, most notably

Table 5: ICT applications and potential biodiversity gains

Biodiversity gain	Details
Practical benefits	ICTs could provide simple, straightforward, practical benefits in conservation areas. These by their nature tend to be relatively remote and isolated, and lacking in ICT infrastructure for the needs of conservation, development and local communities. The presence of an ICT infrastructure can save on time and money by providing improved information flow and basic communications, for example
Protects environments and wildlife	ICTs could allow for more effective law enforcement by providing improvements in administrative and communications capacity, which in turn help to improve environment and wildlife protective measures
Counteracts threats to wildlife	ICTs could allow rangers, park managers and communities to react more effectively to threats (*e.g.*, poaching, fires, encroaching animals)
Park management	ICTs could enable a proactive, speedier and standardised communications platform for park management, resulting in improved environmental management and planning
Data management	Provides a standard platform for recording, sharing, distributing and analysing data (*e.g.*, on elephant populations, GIS, gene pools)
Builds better relations between parks and communities	Improves liaison between park authorities and communities living in and around the parks. Could improve the speed, effectiveness and quality of response. Practical gains for the communities, *e.g.*, requiring assistance on health matters, communication between family members
Improves external communications	Connects conservation areas to the outside world, *e.g.*, to headquarters of NGOs, or overseas
Supports eco-tourism	ICTs could encourage eco-tourism in conservation areas, especially national parks, and can be used in the dissemination of location-specific information to tourists
Supports community-based natural resource management	Helps small businesses in the marketing and selling of products. Improved management of conservation areas can lead to a better use of natural resources which would have both conservation, development and standard of living gains
Raises community awareness on local conservation issues	Community-based websites can increase knowledge and information on conservation issues (local and national), and help promote protection of the local environment

in relation to telecommunications, the practical application of mobile phones in the conservation arena may vary widely within a single project, with new opportunities opening up and presenting challenges the whole time. For example, a project using mobile telephony for basic voice communications may subsequently find a practical use for camera phones in recording environmental events or activities, both in the form of photographs or short video. Furthermore, if the network allows, the same project may then decide to transmit this information electronically, or upload it onto a database. They may also find a use for WAP, which has been available for a number of years and is enabled on a majority of new

and older phones. WAP would allow limited access to the internet, or to basic information services, but again this would be almost revolutionary for some projects working in areas where communication with the outside world has historically been a non-starter.

7.2. ICT use at a practical, hands-on level

At a practical, hands-on level ICTs (and mobile phones in particular) are able to assist with communication between local field offices and national headquarters, or between independent teams working on the ground in conservation areas. Implementation of ICTs at this level can be relatively speedy and straightforward if an adequate infrastructure exists. For example, the expansion of mobile network coverage in Madagascar provided the opportunity for improved field-based communications in and around national parks. The local staff of Durrell Wildlife Conservation Trust recently acquired mobile telephones, vastly improving their ability to communicate (Durrell Wildlife Conservation Trust, 2003). In a similar way, the World Wide Fund for Nature (WWF) put forward a conservation and business case to the mobile phone company, Vodacom, to expand coverage on Mafia Island, off the coast of Tanzania (WWF, 2004a). The use of technology in this programme, however, goes beyond just the use mobile phones (see Box 14).

It is important to recognize that alternative communication systems exist beyond mobile phones, and in some instances these may be more appropriate. For example, high frequency (HF) radios have long provided communications in remote, inaccessible areas, and are commonly used by development and conservation agencies, and the army, even today. Coupled with applications such as Bushmail, which provide full email capability, HF systems can provide cheap and inexpensive communications networks, providing coverage over thousands of square kilometres and in mountainous terrain without the need for the proliferation and expense of masts.

In a similar vein, satellite phones can provide opportunities for voice and data communication in remote areas where HF radio or GSM infrastructure do not exist. For example, FFI's project in Niassa, Mozambique has utilized satellite technology to provide essential communication between project staff and national and international offices. With the continuing fall in costs and the expansion of services such as Thuraya (which has recently extended coverage considerably across Africa), satellite communications may become less of a 'luxury' item and future use of this technology may become more mainstream in conservation and development circles, and may indeed provide competition to mobiles (FFI 2004b).

Box 14: Eastern African Marine Ecoregion Programme (EAME)

WWF-UK has established the EAME programme, with the aim of creating a healthy marine and coastal environment that provides sustainable benefits for local and international communities. The programme covers a vast area of the coast of East Africa, spanning Kenya, Tanzania, Mozambique and South Africa. The activities include computerized baseline studies, ecological and socio-economic monitoring, empowerment of fisherfolk to manage natural resources, mapping and surveillance, protection and establishment of a conservation plan for a key programme site on Mafia Island (Tanzania). Technology will be used in several ways: promoting the extension of GSM coverage to incorporate Mafia Island, using GSM technology to enhance monitoring and patrolling (along with satellite tagging and temperature sensors for monitoring climate change), using GSM technology to track turtles and other marine species, and improving communication networks to build effective stakeholder communities (including the use of wind-up radios for environmental education programmes). Mafia Island is seen as a key area of the programme, with mobile phone technology being introduced in July 2004, which could improve tourism and fishing and other community development projects (*e.g.*, microfinance).

Source: WWF (2003a)

7.3. ICT use for basic data collection

ICTs have many uses in the field of data collection, either in the form of laptop computers, palm top computers or Personal Digital Assistants (PDAs). For example, Cybertracker allows non-ICT-literate users to accurately log and record environmental data using a specially designed icon-driven system, developed for PalmOS handheld computers. In Kenya, the World Conservation Union (IUCN) has also been using PDAs to record the movement of wild animals in national parks.

7.4. ICT use for information, education and research

ICTs can be used for information dissemination, for example with BBC Wildlife Online or FFI's wildlive! initiative (see Box 3), or through the more traditional use of websites. Interestingly, communication of the conservation message is taking place both *in situ* and *ex situ*. In other words, it is being promoted both within and outside countries where specific conservation issues are a pressing concern. Similarly, ICTs are also being used to build up databases or catalogues of a wide range of species. The ARKive project in the UK is a prime example. Described as the "Noah's Ark for the internet era", ARKive aims to build up a visual database of all living things for scientific and historical purposes, and is available openly on the internet (see www.arkive.org).

Another innovative project, Soundwaves, carried out by the Shannon Dolphin and Wildlife Foundation off the coast of Ireland, is developing technology that will allow scientists to understand how dolphins communicate. In turn, the project has enormous educational benefits in that people will be able to listen in on their mobile phones to hear dolphin acoustics and learn about their natural habitat.

Box 15: High Frequency radio networks in Kerinci Seblat National Park, Sumatra

Sumatra's Kerinci Seblat National Park is one of the largest protected areas in South-east Asia and the single most important area for Sumatran tigers. FFI started working at Kerinci with the aim of validating the existence of the undescribed primate, orang pendek. While orang pendek remains an unsolved mystery, the FFI team has been surveying and monitoring the area for five years. It has amassed a wealth of data on numerous species including tigers, elephants and tapirs. Until recently, tiger patrols have been hampered by a lack of communication between Kerinci Seblat and Bangko, but in May 2004 this changed with the installation of a HF radio system (mobile phone coverage does not currently extend to these remote areas). For the first time, voice communication is possible between Kerinci Seblat and the main national parks office, greatly assisting with information sharing and reporting of potential threats to the seriously endangered tiger populations.

Source: FFI (2004)

Box 16: Cybertracker

Invented by Louis Liebenberg in South Africa, Cybertracker is a hand-held device that allows rangers and animal trackers to record what they see at that very moment (using symbols and pictures). The device will then plot maps showing exactly where the observations were made, using GPS. The software can be downloaded free (www.cybertracker.co.za). The only cost is for the actual equipment. One of the first groups to use the Cybertracker were the San Bushmen in Botswana, who have used the device to record various animals and insects (The Economist, 2004b). Cybertracker can be used 'passively', *i.e.*, to record events and sightings during transects or patrols, or more 'directly' – for example, the system played a key role during specific research into the impact of Ebola on the lowland gorilla population in the Congo.

Sources: www.cybertracker.co.za, The Economist (2004b)

7.5. ICT use in community-led conservation initiatives

Many conservation programmes are community-based. WWF's EAME programme (see Box 14) seeks to use modern technologies to support both conservation and community development initiatives, which are inter-linked. Such efforts involve the participation of local community stakeholder groups. In a similar way, FFI and ResourceAfrica are conducting action research with communities in areas around the Kruger National Park in South Africa to introduce and apply appropriate technologies for community-based conservation activities as part of their 't4cd' project. Even in some of the most remote locations, such as the Brazilian Amazon, ICTs are being introduced to communities as part of conservation strategies.

7.6. ICT use for conservation project management

A number of the above case studies contain elements concerned with the improvement of natural resource management, although they can also be seen as specific ICT applications for a particular conservation goal. As discussed, ICTs are being used increasingly to improve the practices of conservation programmes across a range of activities, including monitoring, mapping, planning and management. As with its Eastern African programme, WWF's Panda Conservation Programme in China is making use of mobile phone technology and other ICTs. In a similar way, WWF has lobbied the local mobile phone operator, Sichuan Mobile, to expand coverage in the panda reserves. While the company saw this as good business (in that it could tap into a booming tourist market), WWF saw the benefits for conservation (to improve the monitoring, protection and management of the panda reserves) (WWF, 2004b). Other conservation organizations, such as IUCN and Earthwatch, and DICE in South Africa, are also looking at how different ICTs could be used to improve their overall management of projects. New technology, including mobile phones, is already being used for campaigning and providing information on environmental issues. A good example of environmental monitoring is Global Forest Watch, which is a worldwide network of local forest groups linked via the internet.

While many of these projects are located in one specific country or conservation area, others such as the EAME project are regional in scope, crossing the borders of a number of countries. In southern Africa, the Peace Parks Foundation is aiming to establish Transfrontier Conservation Areas (TFCAs) to enable sustainable economic development through tourism, the conservation of biodiversity and the promotion of regional security by creating better economic conditions for the surrounding communities. The project is using GIS to establish a spatial database for each of the transfrontier conservation areas. Remote data (satellite images) are used to observe the location of settlements as well as their current land-use practices. These spatial databases are tools that will be used during the facilitation and management of the TFCAs and associated projects. Another example is the United Nations Environment Programme (UNEP), which is using technology to develop a decentralized knowledge management system versatile enough to provide wide-ranging information and analytical services on the living world. Called 'Proteus', the project will be based largely on maps and cartographic interfaces. The three

Box 17: Providing remote broadband access, Brazil

The Amazon Association is working with the Solar Electric Light Fund (USA) to introduce broadband internet access to the Caboclo Indians, who live in the Xixuau-Xiparina Ecological Reserve in Brazil and lack basic health, education and economic opportunities. It is envisaged that the internet will provide e-mail, telemedicine, online education and e-commerce, which "promise to radically improve their lives." While this statement is debatable, the technology is being used to help the community report on issues and problems at the reserve, help local women to take orders for their craftwork, promote eco-tourism and support biodiversity research and mapping.

Source: InfoDev (2003c)

Box 18: Panda conservation, China

WWF-UK is making use of mobile phone technology in its conservation of the giant panda in the Min Mountains region of China. Integrated with other activities – such as training in wildlife identification, increasing the size of protected areas and engagement with local communities and tourists – mobile phone technology is being used to help the local staff in their monitoring and patrolling activities in eight reserves, as mobiles are an effective means of communication, and can capture data and pictures. A technology audit in 2003 provided a framework for how technology could improve conservation efforts over three years, at the local level (as is happening), at the landscape level and at the regional level (*i.e.*, educating the public). The impact of technology on the programme is said to be: improving communication between staff, and between staff and their families, in remote locations; communicating panda and biodiversity conservation issues between reserves; and increased coverage in 8 of the 17 reserves. There were several concerns: it could increase tourism even further, which may be unsustainable in terms of eco-tourism; it could enable poachers to communicate more easily with each other; and coverage is still restricted in some of the more mountainous sections of the panda reserves.

Sources: WWF (2003b), WWF (2004)

Box 19: Supporting resource management, Mozambique

The World Conservation Union (IUCN) has implemented a pilot project to see how ICTs can promote conservation and resource management in remote conservation areas of Mozambique: the Niassa Forest Reserve, the Chimanimani Forest Reserve, and the *Tchuma Tchato* conservation project in Tete. At present, mobile phone technology is not appropriate (due to lack of coverage), therefore other ICTs are being tested, including HF radios and e-mail connections. The new technology is providing rangers with a means of communication, allowing them to contact their base station and each other, monitor threats to the wildlife and signs of deforestation, and alert communities to any dangers posed by wildlife (as well as allowing communities to seek immediate help in times of medical emergencies).

Source: IUCN (2003)

fundamental information components of Proteus – species, ecosystems and land or water use – are presented through interfaces that allow the users to choose their own region or country and work from there. The project will use the most advanced hardware and software – provided (and funded) by some of the world's top companies.

7.7 ICT use in tracking and monitoring

Along with GIS systems, satellite and radio tracking is a widely used and popular technology in the conservation world. Recent advances in the technology, principally in the reduction of the size and weight of 'collars', and an increase in battery life (and the incorporation of solar cells), has meant that tracking and monitoring capability is being extended to include smaller species, such as snakes and birds. Further advances mean that environmental data can also be collected, such as air temperature and, for marine animals, depth and heart rate, all of which contributes to a much greater understanding of a species.

Depending on the type of system used, tracking and monitoring technologies enable the monitoring of animal movements over vast distances, often providing data which would either simply not be available, or would take a considerable amount of time and effort to gather. Through the ability to locate specific animals, or groups of animals, and monitor their movements over a period of time, conservationists are able to:

7.7.1. Determine the breeding viability of an isolated group

For example, in Cambodia FFI is seeking to determine whether or not 135 Critically Endangered Siamese crocodiles, scattered over 14 sites, are reproductively isolated or whether they move from river to river. The outcome of this research can assist in determining whether intervention is necessary.

7.7.2. Identify reasons for species decline

In China, little is known about the reasons for the decline of the Tibetan brown bear, and no prior intensive studies have been carried out. By tracking individuals it is possible to determine daily activity patterns within and between seasons and sex-age groups, establish relative density and population size, and assess the characteristics of habitat used by bears. In Eastern Africa, the aforementioned EAME project is also looking to develop community-based monitoring of the five marine turtle populations, partly to look at movement patterns, but also to protect breeding sites.

7.7.3. Assess and reduce human/ wildlife conflict

Identifying, tagging and tracking 'problem' animals can reduce human/wildlife conflict by providing an early warning that an animal is near a village or populated area. Endangered species can then be darted and relocated without the loss of human or animal life. Big cats can be a particular problem, and FFI is working to mitigate community conflict in Ecuador by investigating possible use of the technology to track jaguars, and in Sumatra with the Sumatran tiger.

7.7.4. Assist with park management and planning

Key in the process of creating protected areas is first determining the range and migration routes of the species in question. Without this information it is difficult to identify the most crucial, ecologically relevant sites. Niassa in Mozambique is one of the last sites containing a vital gene pool of tuskers (large bull elephants with tusks) and satellite tracking of individual elephants is seen as crucial in determining their range, prior to establishing the Niassa-Selous transboundary corridor.

7.7.5. Enhance conservation education

Although live, real-time, satellite-tracking data are of immense value to conservation scientists, there is a risk that these may find their way into the wrong hands. The exact GPS positions of elephants, for example, could lead poachers directly to a herd, and many practitioners are aware of such dangers. However, satellite tracking data, in the form of maps and routes, hold a real fascination for the general public and can represent a real tool in conservation education, and in fundraising efforts. For more mobile species – for example birds such as the albatross that travel great distances – the danger in releasing relatively up-to-date information is minimal.

Scientists teamed up with a bookmakers in early 2004 to promote a research project – labelled 'The Big Bird

Box 20: Monitoring seals off Scotland using GSM technology

Although still relatively new, devices combining GPS and mobile phone technology are providing lower-cost alternatives for conservationists needing to monitor species decline or species movement. At present, the major constraint on the uptake of GSM tracking is the availability of a signal – most conservation areas are remote by their very nature, and well out of reach of network coverage.

Off the coast of Scotland, however, the Natural Environment Research Council recently teamed up with the University of St. Andrew's Sea Mammal Research Unit and Siemens Mobile to develop a GPS-based tracking device that monitored the ecology, feeding and longevity of some of the 38,000 seal pups born off the UK each year. The data are transmitted by text message when the pups return to land, and it is hoped this will help to explain why thousands of seals die each year.

Source: BBC NewsOnline (2004)

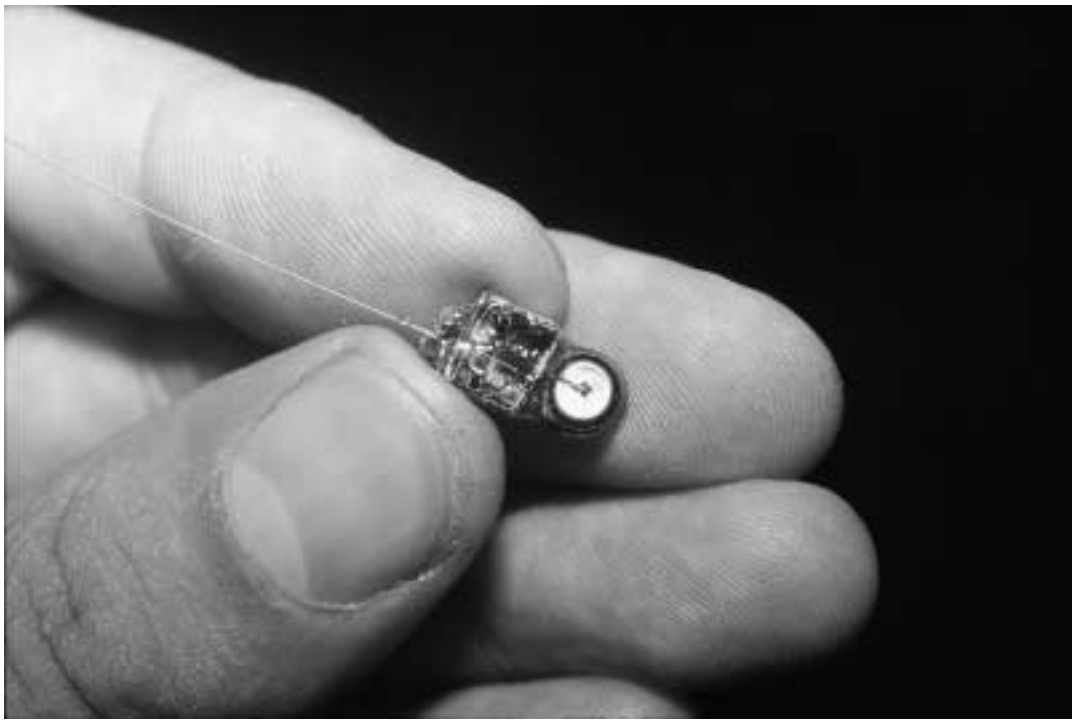


Plate 1: A transponder for Antiguan racer (Alsophis antiguae) *radio-tracking (see Box 23).*
Credit: Mark Day/FFI.

Plate 2: Radio-tracking translocated racer snakes on an Antiguan offshore island.
Credit: Jenny Daltry/FFI.

Plate 3: A Sumatran tiger (Panthera tigris sumatrae) *triggers a phototrap. Photographs such as this provide valuable scientific data on the presence and movement of large terrestrial wildlife.*
Credit: Jeremy Holden/FFI.

Plate 4: Deep in forest, an Asian elephant (Elephas maximus) *is tranquilised prior to relocation. Tracking and monitoring technologies can assist relocation programmes.*
Credit: Jeremy Holden/FFI.

Box 21: Reducing human elephant conflict in Kenya

In a country where approximately 70% of the wildlife regularly roams outside protected areas, clashes with human populations are inevitable. Human encroachment and settlement in buffer zones and protected areas aggravates the problem. At the moment, by the time most villages know that elephants are in the vicinity it is too late to react – the damage may have already been done, usually to crops and property, at worst with injury or the loss of human or animal life. But many of these incidents could be a thing of the past if a new initiative jointly run by Safaricom, Vodafone and Save The Elephants is successful.

The Save The Elephants GSM Animal Tracking Project was launched in Nairobi on 20th February 2004. Running initially for two years, the project will use microchips attached to elephants' ears. Safaricom's mobile phone network will allow their movements to be closely monitored.

According to the Chief Executive of Save the Elephants, Dr. Iain Douglas-Hamilton, this new technology will make it easier to predict and respond to potential human-wildlife conflicts. At the same time it is hoped that more accurate information on wildlife corridors and drinking and feeding locations can be gathered.

Source: wildlive! (2004)

Box 22: Development planning in South Africa

In South Africa a crocodile, codenamed NGCRC1, has become one of the first to be tracked with a new technology – one which combines a GPS and a mobile phone unit in a handy cylinder-shaped container attached to the its back. The four-metre crocodile is being tracked within a 1,600 hectare lake, and the river that feeds into it, at Flag Boshielo over 100 miles north-east of Pretoria. Scientist Hannes Botha hopes to piece together the crocodile's movements. This information will be used to help avoid development in areas where the crocodiles rest, and reduce the potential for conflict with humans visiting the area.

Source: National Geographic (2003)

Race', or 'Ultimate Flutter' – that tracked 18 young albatrosses on a five month, 16,000 mile flight from Tasmania to South Africa. The public was able to track the progress of the birds on-line, feeding into the latest satellite positioning data via maps. Scientists were able to glean valuable data on the migration habits of the birds, the general public was captivated and educated about the plight of the albatross, and all funds were ploughed back into seabird conservation efforts.

7.7.6. Identify farm-bred vs. wild-caught specimens

A major problem facing conservation initiatives that seek to promote the 'controlled farming and breeding' of endangered species (in order to relieve the pressure on wild populations) is finding ways of determining whether individual specimens are genuinely captive-bred, or caught in the wild. Although not a live tracking operation, by injecting small US$4 electronic tags into the scales of ranch-bred crocodiles, conservationists working in South-east Asia are able to identify individuals taken from wild stock. This discourages the poaching of wild crocodiles, since the implementation of such a system makes them harder to sell.

7.7.7. Assess the success of re-introduction programmes

Captive breeding and relocation programmes are central to a number of conservation initiatives. However, accurately monitoring the survival rate of re-introduced or relocated animals can be a problem, and without such data lessons can be hard to learn. With the future survival of some species in the balance, particularly those endemic to small islands, tracking and monitoring technologies are a vital tool.

Box 23: Antiguan racer conservation project

The Antiguan racer, with a population below 150 individuals, is a Critically Endangered snake found on Great Bird Island and Rabbit Island off the north coast of Antigua. Racers were also believed to inhabit Green Island, but were wiped out by alien species, probably rats, in the 1970s. Following a successful rat eradication programme, and follow-up biological studies, it was believed that Green Island might once again be able to support the Antiguan racer snake. Ten racers were released on the island in October 2002, and monitored until July 2003. Central to this monitoring programme were miniature radio transmitters which were surgically implanted into four females. With a margin of error less than 10 metres, the snakes were successfully located using GPS receivers on a daily basis in the weeks following their release.

Source: Daltry *et al* (2002)

7.7.8. Use camera traps as a method of monitoring species

Frequently used by conservationists, camera traps are an additional tool for surveying and monitoring larger species of wildlife. At present, most traps are self-contained devices consisting of various forms of movement sensor, combined with standard SLR cameras. Most digital cameras currently suffer from the heat and humidity, and battery life is highly restrictive, excluding them from use in trapping devices. However, it is only a matter of time before camera traps incorporate digital technology, and then combine it with mobile signals, where available, to transmit images automatically via email.

Not only do camera traps provide valuable scientific data on the presence and movement of large terrestrial wildlife, but attempts are also being made to incorporate them into the heart of community-led conservation projects. By handing over the running of the traps to the local communities, it is hoped that the profits from the sale of images may cover operational costs and provide an incentive for communities themselves to protect their natural resources. Attempts to do this have already been made by FFI and its partners in Indo-China, with the photographic images being categorized as a new form of non-timber forest product (NTFP).

7.8. Issues raised

'Real access criteria' (Box 5) are relevant when considering the impact of many of these ICT applications, since many of the projects are community-based. Interestingly, some of these conservation agencies are taking an integrated ICT approach whilst at the same time trying to meet the varying needs of conservation and local communities. In contrast, a whole range of other ICTs are being applied to conservation work based on a pure scientific need, such as with the tracking of species or the implementation of GIS to map the natural environment digitally. It is unlikely that, in most cases, local communities would engage in this level of scientific research, and as a result it could be argued that the access criteria are less relevant, if not irrelevant.

At another level, the simple introduction of mobile phone coverage into an area can present huge benefits both to conservation organizations working in the area, and to local communities, without the need for any direct conservation NGO intervention. Indeed, NGOs are already encouraging mobile phone operators to extend coverage into national parks and reserves by presenting a strong business and biodiversity case, as with the WWF Panda Conservation Programme in China.

Identifying Appropriate ICTs for Conservation and Development: Southern Africa as a Case Study

8

This section takes a closer look at how information and communication technologies, including mobile phones, can assist in conservation and development work. Also highlighted are areas where these technologies could have potential in helping to stimulate biodiversity gain, and the pre-requisites for their use. The examples are taken from specific research conducted by FFI and its partners in South Africa and Mozambique.

In identifying and selecting technological tools for use within conservation and development projects, it is essential that numerous factors are taken into consideration. Many of these link back to the key access criteria highlighted in Box 5. ICTs should only be applied in the development and conservation context after many of these issues have been considered or addressed. The warning signs are already there – inappropriate use of technology within ICT projects in southern Africa, for example, has led to a notoriously high failure rate. Potential uses need to be established, and then assessed, based on a number of issues including physical access, the need for supporting infrastructure, affordability, trust, maintenance costs, and relevance in a cultural and socio-economic context. All of these factors fall under one general term – appropriateness. Table 6 considers each of these.

Table 6: A summary of ICTs and their potential applications in conservation and development projects, particularly in southern Africa[10]

Mobile phones	*Potential* applications in conservation and development
Services/uses	Voice calls, conference calls, ability to send and receive SMS and MMS messages, access to WAP (via dial-up and GPRS), image and sound downloads, video downloads, Java applications (*e.g.*, games, currency converters, organizers), various specialist Subscriber Identity Module (SIM)-card based applications (*e.g.*, banking, micropayments), personal contact database, calendar, alarm, calculator, integrated digital camera (on some models), voicemail (often with answer-phone facilities), possible use as a PC modem device (with cable, or via infra-red or bluetooth)
Prerequisites for use/issues	Needs a signal and clean power supply to charge, carries cost issues (initial purchase price and running costs), literacy considerations (reflecting on the users ability to learn how to use the phone, perhaps complicated by the (as yet) lack of a standard mobile operating system), risks to personal security (*e.g.*, open to theft), potential access to inappropriate content via WAP sites/premium rate SMS services (if affordable), spamming, potential for fraud/con artists to successfully target inexperienced users, the emergence of mobile phone viruses (which is beginning to happen)
Factors restricting access	In South Africa the cellular networks are available across patches of Bushbuckridge. In Mozambique, the networks are only available in parts of the Maputo Elephant Game Reserve. In both areas, the cost of handsets is a major prohibiting factor for the communities
Potential conservation/ development applications	Mobile phones can assist with easy and quick transfer of knowledge and vital information for small businesses, trading and transport, market prices and goods availability. They can save on costs and time. Meetings can be arranged more easily. Both voice and SMS can be used to raise awareness on conservation issues in the locality. Micro payments could enable microenterprises to make transactions or savings. Mobile phone use within protected areas could provide rangers with improved communications, which in turn improves the effectiveness of patrols and could reduce poaching. They could also provide access to information services, which could be used to alert rangers to the movement or incidents of poaching in the area, or to weather warnings. The use of SMS alerts could warn communities and rangers when elephants or tigers are in the area, reducing incidents of human/wildlife conflict

[10] *Taken from a project proposal by FFI and ResourceAfrica, 'Technologies for Conservation in Southern Africa', December 2003.*

Table 6 – continued

Desktop PC	*Potential* applications in conservation and development
Services/uses	PC software applications are almost unlimited, but include accounting, e-mail, word processing, spreadsheets, internet (including the making of video calls, and using Voice over IP), database, general Windows-based add-ons (calendar, calculator *etc.*), graphics/publishing, teaching (CAL), software development environments (such as Visual Basic, C++), bespoke (specialist) applications (such as stock management systems), voice recognition, CD/DVD burning, watching movies (useful for educational purposes), text (OCR) and image scanning (needs additional hardware), photo imaging (using digital cameras), production of soundtracks and small movies (for educational purposes), fax facility, printing (needs additional hardware), games (educational or otherwise)
Prerequisites for use/issues	Needs a clean, regular power supply, issues of both data and hardware security, viruses (via the web and floppy disks), literacy level (general language and PC-related literacy), requires a telephone connection for internet and email (a key application for many), provision of hardware and software support, curiosity (*e.g.*, danger of opening up unit), appropriateness in regards to the local environment (*e.g.*, excess heat, humidity), ergonomics for safe use (*e.g.*, appropriate desks, chairs, space, accessibility, cable management), open to abuse (*e.g.*, physical damage) and users re-configuring shared units for their own use, password abuse, issues of ownership (*e.g.*, who has access and when, and who doesn't), culturally inappropriate content via the web (*e.g.*, pornography), needs a culture of saving data/backing up, overall issue of Open Source (*e.g.*, Linux) vs. proprietary software (*e.g.*, Windows), danger of creating an over-reliance on the technology
Factors restricting access	For internet and email access, the availability of landlines is an issue in Welverdiend. In Mozambique, a hundred lines should be available in the Limpopo Reserve. Sentech offers internet delivery by satellite, though at a cost of about R3000 per month (summer 2003)
Potential conservation/ development applications	Provides improved NGO and field-office administrative capacity, and opens up the possibility of data sharing between offices and NGOs nationally and internationally. Allows information to be maintained in a standard, transportable electronic format, along with access to the internet and e-mail for improved research and web-based database applications. The use of personal computers also opens up the potential use of Graphical Information Systems (GIS), often regarded as one of the most useful, if not the most common, ICT-based conservation application

Table 6 – continued

Laptop PC	*Potential* applications in conservation and development
Services/uses	PC software applications are almost unlimited, but include accounting, e-mail, word processing, spreadsheets, internet (including the making of video calls, and using Voice over IP), database, general Windows-based add-ons (calendar, calculator etc), graphics/publishing, teaching (CAL), software development environments (such as Visual Basic, C++), bespoke (specialist) applications (such as stock management systems), voice recognition, CD/DVD burning, watching movies (useful for educational purposes), text (OCR) and image scanning (needs additional hardware), photo imaging (using digital cameras), production of soundtracks and small movies (for educational purposes), fax facility, printing (needs additional hardware), games (educational or otherwise)
Prerequisites for use/issues	Similar to above (see Desktop PC). Battery and mobility make it easier to use laptops, although batteries tend to have relatively shorter lives if not handled properly, particularly in hot and humid environments. Additional issue of security due to their portability, and repair (unlike a PC, the modular design of a laptop makes it difficult to replace the keyboard, or monitor, should a fault develop)
Factors restricting access	For internet and email access, the availability of landlines is an issue in Welverdiend. In Mozambique, a hundred lines should be available in the Limpopo Reserve. Sentech offers internet delivery by satellite, though, in mid-2003, at a cost of about R3000 per month
Potential conservation/ development applications	Provides improved NGO and field-office administrative capacity, and opens up the possibility of data sharing between offices and NGOs nationally and internationally. Being portable, laptops are easily taken into the field, providing continued administrative and communication support where it is most needed. They also allow information to be maintained in a standard, transportable electronic format, along with access to the internet and e-mail for improved research and web-based database applications (if combined with a mobile phone if used remotely, *e.g.*, in the field). The use of laptops also opens up the potential use of Graphical Information Systems (GIS), often regarded as one of the most useful, if not the most common, ICT-based conservation application

Table 6 – continued

PDA/phone unit	*Potential* applications in conservation and development
Services	In addition to general mobile services (see 'Mobile phone' section), very basic Microsoft CE-style software (or Symbian, depending on make and model) – which may include word processing, spreadsheet, database, accounts, calendar, alarm, contact book, integrated camera for imaging, Java applications (*e.g.*, games), SIM-card based specialist applications (*e.g.*, banking), the ability to run other specialist applications (*e.g.*, for data collection, such as Cybertracker), ability to use as a modem (no need for cables or connection if the PDA has integrated GSM capability)
Prerequisites for use/issues	State-of-the art technology PDAs (such as the HP iPAQ) and combined phone/PDAs (*i.e.*, Sony Ericsson P900) are expensive and not easily available in some markets, carries a literacy issue (as with computers), is a more complex technology, probably only for specialist (targeted and appropriate) use, the phone element needs a GSM signal, may need insurance (*e.g.*, to protect against loss, theft and damage), will need a clean, reliable power supply to charge, issues of personal security (*e.g.*, theft), inappropriate or offensive content via WAP sites/premium rate SMS services (if affordable), spamming, fraud/con artists targeting inexperienced users, fragility of touch-screens and repair issues, appropriateness to the local environment (*e.g.*, excess heat, humidity), availability of technical support
Factors restricting access	Availability is limited by cost. There would be no perceived value for the communities to purchase given bread and butter issues. They would only engage through external intervention, or through the availability of appropriate applications (such as Cybertracker)
Potential conservation/ development applications	Combined mobile phone/PDA units are still relatively new in the Western world, and as a result there is little track record of their use in the conservation or development fields (other than for Project Managers perhaps using them for note taking, or keeping appointments/ contact details). Likewise, the development and potential use of these devices in a conservation context is in its infancy. However, due to the nature of the device it could perhaps be one of the few true ICT devices in that it provides both computing power and full communications capability in one unit. It is most likely that the PDA will find a niche in the collection of species-specific data, such as species counting, identification and so on, and this combined with the ability to take pictures and then electronically transmit data seamlessly makes it a very attractive proposition. IUCN in Mozambique are already investigating the use of PDA devices for such tasks

Table 6 – continued

Satellite units	*Potential* applications in conservation and development
Services	Voice calls, SMS-style application, modem possibilities, GPS built into some units (or available as an add-on), other built-in software (as with standard mobile phones – see earlier section). In terms of data, always-on-GPRS-style connections are available through an external 'dish' providing fast internet access and email in the field via a laptop
Prerequisites for use/issues	As a state-of-the-art technology satellite phones are expensive for individual use, but costs have began to come down dramatically. Users need to sign a contract and have a bank account (no Pay-As-You-Go option) which is a barrier for many rural people (and makes it harder to control costs), issue of insurance (recommended due to equipment cost), numerous systems are available which can be confusing, the service may not always be available depending on the system (*e.g.*, satellite positioning), high number of use and cost 'bands' depending on network being called, SMS expensive in relation to GSM (three times the cost on average, depending on network), users need a clean, reliable power supply to charge the unit, low battery life compared to GSM mobiles, possible health issues with use, personal safety (*e.g.*, theft), if the unit is shared there are issues of ownership and access
Factors restricting access	The cost of handsets and per minute call costs mean that communities are only likely to engage through interventions. In the Limpopo National Park, the management office based at Massingir relies upon satellite phones to communicate to the headquarters in Maputo. It is most likely that for some time, satellite communications will be restricted to use within project management, and not become a communications tool used by target communities
Potential conservation/ development applications	Satellite phones have traditionally been, and in many instances still are, the default communications tool for conservation and development organizations working in the field. Due to a reduction in costs, and the growth of portable satellite-based data communications, satellite provides a very real solution for not only voice but also for remote internet and email access. However, with the expansion of GSM networks globally, and the affordability of GSM equipment over satellite, implementation of mobile phone technologies is on the rise. This is particularly true in the case of voice communications, but often for high-speed data needs satellite could still be considered the most appropriate, although the implementation of 3G networks could again challenge this

Table 6 – continued

Fax	*Potential* applications in conservation and development
Services	Voice calls (usually), document transmission, photocopying (usually)
Prerequisites for use/issues	Needs a land-line, a regular, clean and reliable power supply, some of the cheaper faxes use thermal rolls as paper (which is not appropriate in hot climates as they eventually fade), engineering support needed in times of breakdown (quite common with cheaper fax and copier machines, which can easily jam), requires toner and plain paper supplies (non-thermal models, although they require rolls)
Factors restricting access	Availability of lines is patchy in Welverdiend. In Mozambique, a hundred lines should be available in the Limpopo Reserve.
Potential conservation/ development applications	Very few specific conservation-related applications for the fax machine exist, except for the obvious ability to transit documents between offices nationally and internationally. PC-based fax applications have existed for some time, removing the need for dedicated fax machines, and email has to a large degree replaced the need for facsimile transmissions

Table 6 – continued

HF radio	*Potential* applications in conservation and development
Services	Voice communication from a fixed-point base station and/or mobile back-pack, SMS-type application, e-mail facility, GPS built into some units (or available as add-ons), ability to link into GSM and Public Switched Telephone Network (PSTN) networks via a 'tele-interconnect', once a network is established communications over it are free (unless specialist applications such as Bushmail are used, which carry a fee)
Prerequisites for use/issues	An established, widely-used (but old) technology, each base station needs a regular, reliable power supply (although solar power is an option), a degree of training is required to understand the HF concept and frequency operation, weather can impact on its use (*e.g.*, can determine the most appropriate frequency to be used), e-mailing slow (usually has to be done overnight) with attachments impractical, web browsing not possible, ownership and access is an issue with portability of back-pack equipment, these back-packs can weigh 7kg (may be an issue for young or elderly), the ability to connect to PSTN and GSM networks depends on the availability and reliability of nearby land-lines, each base station aerial needs good clearing and proper set-up, there are always possible maintenance issues (although HF is proven in harsh environments), the battery life of hand-held (back-pack) units is generally low
Factors restricting access	Limited potential uptake at the community level means that no commercial provider is likely to engage the communities (economies of scale). HF radio will probably remain the communications method of choice for many projects until GSM networks provide coverage (even then they may use a combination of the two technologies due to mobile cost)
Potential conservation/ development applications	As with other hardware (*e.g.*, satellite) HF radio tends to be used when there is no landline or GSM network. In the case of HF radios, they can assist both the conservation agency in basic communication (with staff and with headquarters) and with communities (*e.g.*, in the establishment of a community radio). Raising awareness, improved security and basic communication are advantages. HF radios can also be used to provide email access (*e.g.*, Bushmail).

Table 6 – continued

Others	*Potential* applications in conservation and development
Television and video	Could provide education, information and entertainment via dedicated TV units or through PC TV cards. Already widely available in South Africa. No television signal is available in the intervention areas in Mozambique except for the Maputo Elephant Reserve
Radio	Could also provide education, information and entertainment. Wind up or battery (which usually also run off the mains). Community and national radio available in South Africa. Radio signal is available in the intervention areas in Mozambique except for the Maputo Elephant Reserve that receives state radio
Low-cost alternatives	**Applications**
Open Source software (for PCs and laptops)	As opposed to proprietary software, such as Microsoft Windows, open source provides the user with access to both compiled and source versions of the software. This allows the user to make custom changes (*e.g.*, alter menu, add or remove functionality, change the display language), assuming an ability to program. While providing this added functionality, Open source software generally costs a lot less than its proprietary cousin, and this is another reason for its uptake in the developing world (*e.g.*, Brazil) and for its continuing and increasing use in the developed world
Fidonet	Much focus on alternative ICTs concentrates on hardware alternatives, and hardware which allows the most appropriate access to the internet. Fidonet is, in fact, an alternative to the internet (and particularly email) itself. Fidonet can run on the very simplest and oldest of PCs and works on a dial-up system, where messages are sent to machines which collect them up, and then in turn forward them onto other machines via further dial-ups. Although not a perfect substitute for TCP/IP, Fidonet is far from a 'low technology' solution and is in fact quite sophisticated
The Simputer	The Simputer, an Indian invention, is a low-cost multi-user computer which provides access to a whole range of software applications. At around US$200 its secret lies in the use of open source software, the use of smartcards to allow multiple users to access the same machine, and the utilisation of off-the-shelf components, bought in bulk
The Volkscomputer	Another low-cost example is the Volkscomputer, commissioned by the Brazilian government. The secret behind this system is that it is basically a stripped-down computer, with among other things no hard disk or floppy drive. This keeps costs down considerably, does not come at the expense of functionality and provides the user with exactly what they need (with little or no expensive and unnecessary extras)

Table 6 – continued

Low-cost alternatives	Applications
New Internet Computer	A similar concept was put to work in the United States, where the 'New Internet Computer' was born. This machine is designed for users who only need email and internet access, and costs approximately US$200. The secret in the price once again lies in the logic of not providing features and applications that the user does not need
Internet box	Currently available in the UK (through ntl: for example), set-top boxes which provide internet access and email through normal televisions are becoming more and more popular in some developing countries, particularly India. The key again is cost, and the integrated nature of the equipment (radio, television and internet browser all-in-one).
Digital switches	One of the best examples of an appropriate technology is the C-DOT switch. Designed at the Indian Centre for Development of Telematics (C-DOT) this digital switch, unlike many of its western counterparts, can work in tropical, humid and non-air conditioned environments. Over 29,000 exchanges have been built and fitted with these switches in India alone, most in rural villages. The C-DOT switch is also a good example of an appropriate 'supporting' technology, in that it is not something that the end user particularly need be aware of, or purchase themselves

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Mobile phone technology is developing at an extraordinarily rapid pace and is being applied to an increasingly wide range of human activities and the environment in which we live. It brings both benefits and challenges. This report looks at the implications and applications of mobile phone technology on conservation and development initiatives in the developing world. It takes into account the integration between mobile phones and other Information and Communication Technologies (ICTs), identifying ways in which mobile phones play a role in the digital divide debate. Having considered government, donor, business and NGO policies towards mobile phones and other ICTs, the report details a number of case studies where they are being applied to development and conservation work.

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The Vodafone Group Foundation is driven by a *Passion for the World Around Us*. The Foundation makes social investments that help the people of the world to have fuller lives by:

- Sharing the benefits of developments in mobile communications technology as widely as possible
- Protecting the natural environment
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